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FARLOWIA

A Journal of Cryptogamic Botany

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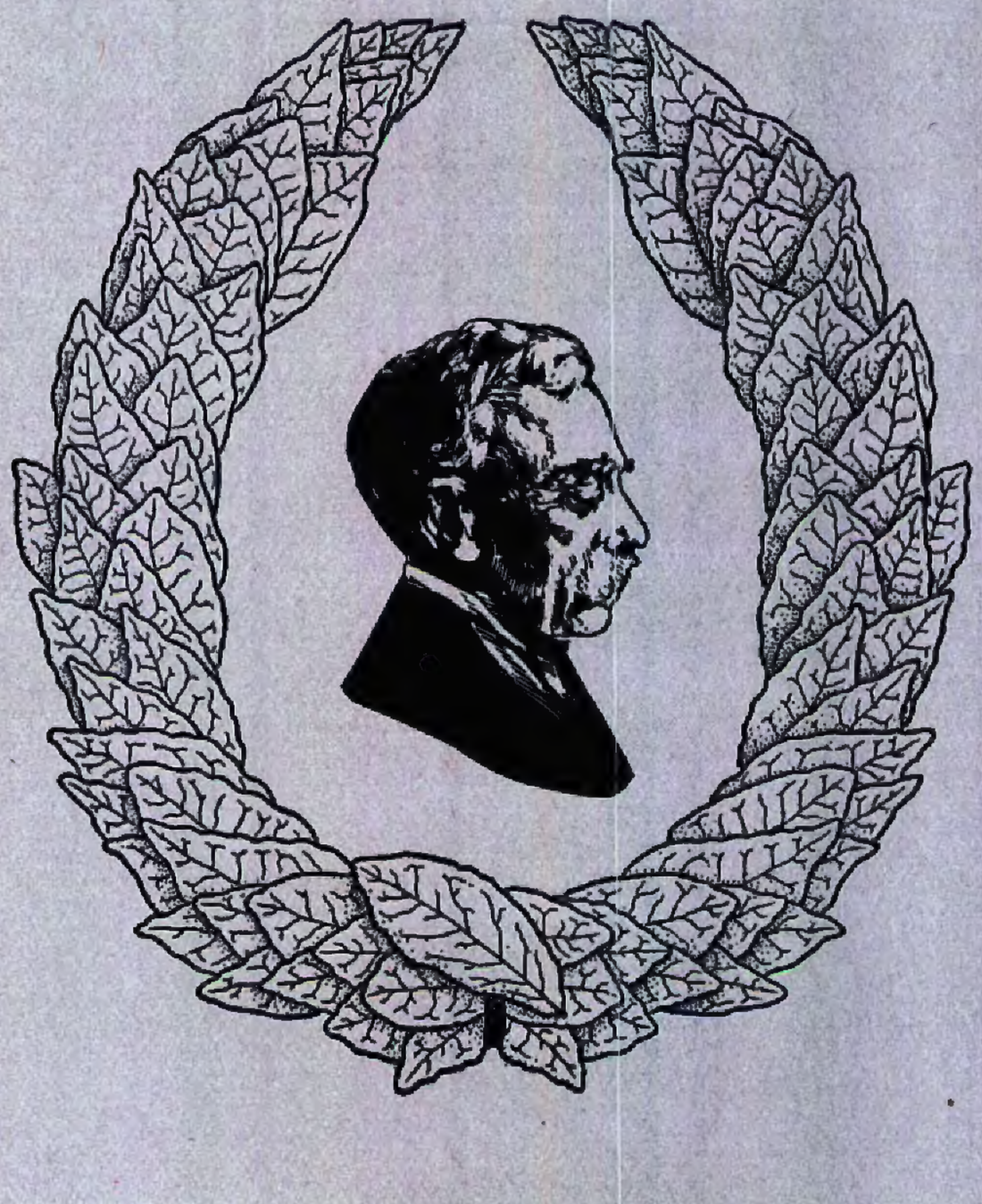

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David Hunt Linder

September 24, 1899

November 10, 1946

It is with deepest sorrow that the Staff of Farlowia records the passing of their Editor in Chief, David H. Linder. His unusually wide knowledge of biology, especially in his chosen field of cryptogamic botany makes his early death a great loss to science. His always gentle and kindly help will be missed indeed by his multitude of friends the world over.

FARLOWIA

A JOURNAL OF CRYPTOGAMIC BOTANY

VOL. 3 JANUARY, 1947 No. 1

THE MARINE ALGAE OF OREGON [1]

PART I. CHLOROPHYTA AND PHAEOPHYTA

MAXWELL S. DOTY

INTRODUCTION

This study, a report on the marine algae known to occur along the Oregon coast, is based for the most part on the author's collections. Chief among the other sources of material have been the herbarium of the University of California and the Dudley Herbarium of Stanford University. The collections of Orla Ray O'Neal, the author's companion during most of the field studies, have provided a great number of novelties and records that otherwise would have been unobtainable. Very important records have been obtained from the herbarium of the Oregon Institute of Marine Biology, and from the collections of Professors Wayne Wells, at the Southern Oregon College of Education, and F. P. Sipe of the University of Oregon. Sources of material are cited by the herbarium number or other identifying data preceded immediately by the name of the collector (*MD* in the case of the author's collections) or the herbarium in which the material is deposited.

All types of new species and varieties, representative specimens of all the species collected, and specimens of significance in geographical distribution, are deposited in the Dudley Herbarium of Stanford University. As far as the material permitted, specimens have been deposited in the Farlow Herbarium of Harvard University, the herbarium of W. R. Taylor at the University of Michigan, and in the herbaria of the Chicago Museum of Natural History and the University of California. Because of the large number of specimens examined and because many are very well known, only specimens of special interest or those distributed are cited specifically in the text.

Unless otherwise stated the ranges cited and the records for the occurrence are based upon the author's investigations. In most cases bibliographic references are limited to the most pertinent publications and to those in which additional bibliography may be found.

[1] The systematic portion of studies of this region carried out and presented to the School of Biological Sciences of Stanford University as a doctoral dissertation. The second part of this paper, with the bibliography, is to appear in the next number of this journal.

VERTICAL DISTRIBUTION

In Oregon as elsewhere along the Pacific Coast of North America there is a pronounced difference between the levels to which two successive low tides fall. The same is true of the maximum levels of two successive high tides. This results in the establishment of at least six critical breaks or levels in the intertidal zone. For the sake of brevity the levels are cited by the abbreviations [2] LLLW, MLLW, LHLW, HHLW, LLHW, and LHHW. The lowermost level (LLLW) is the lowest level to which the tides recede. The next level above this (MLLW) is the mean of the lower of the two low waters of each day. Next is the highest level (LHLW) uncovered no more than once each day. Above this the next level (HHLW) is near mean sea level. The next (LLHW) is the lowest level covered (and uncovered) at least twice each day. The uppermost level (LHHW) is the highest level covered every day.

The elevation of these critical levels in respect to mean lower low water at any given place along the coast is in turn dependent upon the mean range of tides there. For example, at Brookings the mean tidal range is 5.1 feet, at Wederburn at the mouth of the Rogue River the mean tidal range is 4 feet, and at Youngs Bay near Astoria the mean tidal range is 6.7 feet. The zones delimited by these critical levels are correspondingly narrow or broad as the mean tidal range is small or large. Because of the above facts the vertical distribution of the species is noted in reference to these levels rather than in feet above or below some datum point.

The lowest level (LLLW) to which the lowest tides recede is the upper limit of the vertical distribution of *Laminaria Andersonii*. Widely distributed algae between the lowest level to which the lowest tides fall and the mean of the lower of the two low waters of each day are *Pikea*, *Rhodymenia*, *Polyneura*, *Zanardinula*, and *Laminaria Sinclairii*. Characteristic algae of the zone between the mean of the lower of the two low waters (MLLW) and the highest level uncovered but once each day (LHLW) are *Hedophyllum sessile*, *Egregia Menziesii*, *Gigartina canaliculata*, and *Rhodomela larix*. Characteristic algae of the zone between the LHLW level and the highest level always uncovered twice each day (HHLW) are *Iridophycus flaccidum*, *Gigartina Agardhii*, and *Cladophora trichotoma*. The zone between HHLW and the highest level covered at least twice each day (LLHW) is indicated by *Endocladia muricata*, *Gigartina papillata*, and *Pelvetiopsis limitata*. A less consistent zone often occupied by *Gloiopeltis furcata* and *Hildenbrandia* extends, then, up to the highest level covered at least once each day (LHHW). Above the LHHW level the dominant algae are *Prasiola meridionalis*, *Por-*

[2] These abbreviations are taken from the following characteristics of the tides: LLLW, lowest lower low water level; MLLW, mean lower low water level; LHLW, lowest higher low water level; HHLW, highest higher low water level; LLHW, lowest lower high water level; and LHHW, lowest higher high water level. For further elaboration see Doty, Ecology **27:** 315–328. 1946.

phyra schizophylla, and *Rhodochorton purpureum*, but these are very restricted in distribution.

STATIONS AT WHICH COLLECTIONS WERE MADE

As originally planned it was hoped that extensive collections could be made from all the stations selected approximately 30 minutes of latitude (25 to 30 miles) apart along the entire coast of Oregon from St. George's Reef in northern California to the Columbia River Bar. Wartime rationing of gasoline during the past few years has necessitated curtailment of this plan and intensive collecting has been restricted to the coast between California and Coos Bay.

Names of collection stations to be found on U. S. Coast and Geodetic Survey hydrographic charts 5702, 5802, 5902 and 5984 are designated as *official*. *Unofficial* names do not appear on Coast and Geodetic Survey charts but are on maps published by the Oregon State Highway Department. *Local* names are those employed by the local residents or collectors. Stations with unofficial and local names are to be found on the Coast and Geodetic Survey charts either from the latitude (north latitude in all cases) given or by cross reference to official names. Since all stations along the coast are between 123° 36′ and 124° 34′ west longitude, the longitude for individual stations is omitted.

AGATE BEACH. Unofficial name for the rocky beach accessible along the southern shore of Yaquina Head.

BOILER BAY. (44° 50′) Unofficial name for an exposed field of huge boulders that is exposed to the northwest and protected from the southwest by high reefs.

BROOKINGS. (Between 42° 1′ and 40° 2′) Official. Next to Cape Arago, this area is second in importance in the way of supplying the data included herein.

BROOKINGS COVE. Local name for Macklyn Cove.

BROOKINGS POINT. Local name for Chetco Point.

CANNON BEACH. Official name for the beach north of Haystack Rock.

CAPE ARAGO. (Between 43° 16′ and 43° 21′) Official name for the series of headlands and coves extending 10 miles southward from the entrance at Coos Bay. The search for algae has been more intense here than at any other station.

CAPE BLANCO. Official name for the most westerly point of land in the United States at 42° 50′. An extremely exposed tongue with both a long northern and southern rocky shore.

CAPE LOOKOUT. (45° 20′ 30″) Official.

CAPE MEARS. (45° 29′) Official.

CAPE PERPETUA. (44° 17′) Official.

CASCADE HEAD. (45° 17′) Official.

CHARLESTON. Unofficial. A village on the western shore of South Slough near the site of the Oregon Institute of Marine Biology.

CHETCO COVE. Official. A part of the Brookings area.

CHETCO POINT. Official. A part of the Brookings area.

CLATSOP SPIT. (46° 14′) Official. As used here it includes both the area of the spit proper and the south jetty at the mouth of the Columbia River.

COOS BAY. (Between 43° 21′ and 43° 28′) Official name for the bay immediately north of Cape Arago.

COOS HEAD. Official. A part of the Coos Bay area.

EMPIRE. Official. A part of the Coos Bay area.

FIN ROCK. Unofficial name for a large and conspicuous fin-shaped rock off the southern shore of Cape Blanco.

FOSSIL POINT. Official. A part of the Coos Bay area.

HARRIS STATE PARK. Unofficial name used here to designate not only the park area itself, but also the rocky coastline south to the northern tip of Macklyn Cove.

HAYSTACK ROCK. (45° 53′) Official. Including the rocky boulder field about this rock and adjacent rocks.

HECETA HEAD. (44° 8′) Official. The rocky beach to the south and the rocks near the mouth of Cape Creek.

LIGHTHOUSE BEACH. Local name for the beach just north of the Cape Arago lighthouse on Cape Arago.

LIGHTHOUSE REEF. Local name for the reef upon which is situated the Cape Arago lighthouse.

MARSHFIELD. Official. Recently renamed "Coos Bay".

MIDDLE BAY. Unofficial name for the cove indenting the most south-westerly tip of Cape Arago.

MUSSEL REEF. Local name for a series of reefs on Cape Arago just north of Lighthouse Reef and Lighthouse Beach.

NEHALEM BAY. (45° 39′) Local name for the south jetty at the mouth of the Nehalem River.

NORTH BAY. Unofficial name for the cove and boulder field north and northwest of the most southwesterly tip of Cape Arago.

NORTH BEND. Official. A city on Coos Bay.

OCEANSIDE. (45° 28′) Here used to indicate the collecting area between Three Arch Rocks and Cape Mears.

OTTER POINT. (42° 28′) Official name for a part of the base of the Rogue River Reef. All collections are from the south side of this point.

OTTER ROCK. (44° 45′) Here used to refer both to the beach and caves near the town of this name — all inshore and somewhat north of the rock officially bearing this name.

ROGUE RIVER REEF. (Between 42° 37′ and 42° 28′) Official. The only collecting on this reef was done along the shore south from Otter Point.

SEAL ROCKS. (44° 30′) Official.

SHORE ACRES. Local name for the region immediately south of Sunset Bay.

SHORT SAND BEACH. (45° 45′ 30″) Unofficial name for the largest of the coves between Neahkahnie Mountain and Cape Falcon (both official names).

SIUSLAW BAY. (43° 45′) Unofficial.

SIUSLAW JETTY. Local name for the north jetty at the mouth of the Siuslaw River.

SOUTH BAY. Unofficial name for South Cove.

SOUTH COVE. Official. On the southern protected side of the most southwesterly tip of Cape Arago.

SOUTH JETTY. Local name for the south jetty at the entrance to Coos Bay.

SOUTH SLOUGH. Official. An arm of Coos Bay.

SQUAW CREEK. (44° 12′ 30″) All collections are from the rocks at the mouth of this stream.

SQUAW ISLAND. Unofficial name for the tree-covered island in the mouth of Sunset Bay.

SQUAW ISLAND REEF. Local name for the reef connecting Squaw Island to the mainland and extending on beyond the island into the mouth of Sunset Bay.

SUNSET BAY. Unofficial name for the bay just south of Lighthouse Reef.

SUNSET BEACH. Local name for Sunset Bay.

TEGULA BAY. Local name for the first small bay south of Sunset Bay.

TILLAMOOK HEAD. (45° 56′ 30″) Official.

WINCHESTER BAY. (43° 41′).

YACHATS. (44° 19′) Official. Here used to designate the area just north of the river by the same name.

YAQUINA BAY. (44° 37′) Official.

YAQUINA HEAD. (44° 40′ 30″) Official. The collecting grounds are principally at Agate Beach on the south side.

ACKNOWLEDGMENTS

The author's indebtedness to the many persons and institutions mentioned throughout the text is obvious, but the kindnesses of the following must be mentioned in particular. Dr. W. R. Taylor obligingly lent the author his collections of *Enteromorpha linza*, and provided notes on other subjects. Through numerous cheerful courtesies, Dr. George F. Papenfuss has made the author feel at home in the University of California herbarium and in the library of the late W. R. Setchell. Dr. George J. Hollenberg, especially early in the course of this study, gave constant assistance and a large number of careful determinations and critical comments on specimens sent him, some of which are described herein either as new species or species heretofore poorly known. Finally, I am greatly indebted to Dr. G. M. Smith, under whose direction the original dissertation was undertaken and completed.

ANNOTATED SYSTEMATIC LIST

DIVISION CHLOROPHYTA

TETRASPORALES

CHLORANGIACEAE

COLLINSIELLA Setchell & Gardner, 1903

Collinsiella tuberculata Setchell & Gardner, 1903:204. *pl. 17, figs. 1–7*; — Setchell & Gardner, 1920b:144. *pl. 10, figs. 4–10*; — Smith, 1944:31.

The range of this species is given by Setchell & Gardner as Vancouver Island and Central California. Several tetrasporine green algae have been found in typical habitats, but none could be *clearly* identified as this alga.

ULOTRICHALES

ULOTRICHACEAE

ULOTHRIX Kützing, 1833

Ulothrix flacca (Dillwyn) Thuret *in* LeJolis, 1863:56; — Setchell & Gardner, 1920b:284.

A very few isolated strands of this species have been identified among collections of various other algae from mid- and high tide levels at different stations on Cape Arago.

Ulothrix implexa Kützing, 1849:349; Setchell & Gardner, 1920b:283; — Smith, 1944:34. *pl. 1, figs. 4–5.*

One collection (*MD 5988*, Middle Bay) has been made from rocks around and protruding from tidepools at plus 10 foot tidelevels. This was mixed with a juvenile thallus of *Enteromorpha clathrata*. About one third of the cell wall is left uncovered by the chloroplast and the cells are mostly 2–2.5 times as long as broad.

Ulothrix zonata (Web. & Mohr) Kützing, 1833:519; — Collins, 1909b:184.

Filaments 45 μ in diameter with the cells 0.5–1.5 times as long as broad; basal cells regularly tapered or rectangular and usually 2 or 2.5 times as long as broad, as are the next few cells above.

This species has been found in the mouths of creeks reached by the highest spring tides. Either it develops between such high tide periods or is able to stand the few hours of exposure to salt water during these high tides. There are two collections (*MD 6210*, one quarter mile south of Harris State Park, July; and *MD 6299*, Squaw Creek, September) that have been collected from boulders in such localities. This alga is common in Oregon maritime streams.

Ulothrix pseudoflacca Wille, 1901:22; — Setchell & Gardner, 1920b:285.

This species is reported from Cape Arago by Sanborn and Doty (*ined.*). The writer has not been able to examine these specimens during the course of this study.

HORMIDIUM Kützing, 1843

Hormidium rivulare Kützing, 1845:192; — Hazen, 1902:166. *pl. 22, figs. 10–13.*

PLATE 5, FIGS. 2–4; PLATE 6, FIGS. 1–9

Older filaments becoming irregular in size and in diameter up to 12 μ, most of the filaments about 9 μ with the smallest 7–8 μ in diameter and then very regular in size; cells up to as long as broad except where rhizoidal branches are forming; no starch found in younger filaments but in the older and larger filaments pyrenoids with concavo-convex pyrenoid-starch grains around them may be found; there is very little stroma starch, if any, and the pyrenoids are for the most part at the ends of the chloroplasts; the chloroplasts nearly filling the cells; rhizoidal branches at intervals of two to three hundred cells at the most.

Forming a green felty layer on the woodwork of a wharf at Winchester Bay (*MD 4716*, early July). *H. rivulare* has previously been considered a strictly fresh-water species. While most of the water that bathes the site is fresh water, this particular site is often washed with sea water during the landing and weighing of the fishermen's catches, and in the lower reaches probably by the highest of the high tides.

In rhizoidal branches the chlorophyllous material was often, at least in the largest branches, diffused through the whole cell as though the cell were in a poor state of health and disintegrating. The mass of mucilaginous substance about the tips of the larger rhizoidal filaments often contained cells or fragments of cells entirely separate from one another but often distinctly oriented in the same manner as cells of a rhizoidal filament. It is uncertain whether or not these *Stichococcus*-like cells were budded off from the rhizoidal branches, whether they are merely passively caught as foreign bodies in the gelatinizing matrix, or whether they are the products of rhizoidal branchlets undergoing disintegration.

CHAETOPHORACEAE

ENTOCLADIA Reinke, 1879

Gardner in his notes under *2743* records the genus *Endoderma* from *Cladophora flexuosa* collected near North Bend. It is presumed that this was some species of the genus *Entocladia*. The specimen was not seen.

PSEUDULVELLA Wille, 1909

Pseudulvella consociata Setchell & Gardner, 1920a:296. *pl. 24, figs. 4–6*; — Setchell & Gardner, 1920b:297. *pl. 19, figs. 4–6.*

There are two collections from South Bay (*MD 4150* and *4089*, both collected in January), the former on the shells of living *Tegula funebralis* and the latter on a limpet (*Acmaea* sp.) in an exposed situation.

ENDOPHYTON Gardner, 1909

Endophyton ramosum Gardner, 1909:372. *pl. 14, figs. 3–4*; — Smith, 1944:36. *pl. 1, fig. 6.*

Found once at Brookings in the fronds of *Dilsea californica* (*MD 6123*), and in Gardner's notes recorded from *Callophyllis* at Cape Arago.

PSEUDODICTYON Gardner, 1909

Pseudodictyon geniculatum Gardner, 1909:374. *pl. 14, figs. 5–6*; — Setchell & Gardner, 1920b:293. *pl. 11, figs. 5–6*; — Smith, 1944:37.

Under number *2783* in his notebook Gardner records this species on the outer ends of *Laminaria Sinclairii* fronds from Sunset Bay.

The author has several times found filamentous green algae endophytic in Laminariales that seemed to be this alga, but which could never be determined with certainty.

TRENTEPOHLIACEAE

TRENTEPOHLIA Martius, 1817

In many places this well-known fresh water genus extends from strictly aerial to supra- or quasi-marine habitats. Setchell & Gardner (1920b:306) identify the *Trentepohlia* in quasi-marine habitats in southern California as *T. odorata* var. *umbrina* (Kütz) Hariot. The Oregon material does not seem to be *T. odorata*, nor any of its varieties.

GOMONTIA Bornet & Flahault, 1888

Gomontia polyrhiza (Lagerheim) Bornet & Flahault, 1888:163; — Smith, 1944:41. *pl. 1, figs. 8–11*; *pl. 2, figs. 1–7.*

The Oregon specimens show the same variation as described by Smith. One collection from Coos Bay (*MD 4894*) was in the skeletons of sea urchins (*Strongylocentrotus purpuratus*). Other collections from Coos Bay have been made from the shells of *Protothaca staminea*, *Clinocardium nuttallii*, *Saxidomus gigantea*, *Macoma irus*, and *Macoma kelseyi*, all bivalves.

On the west coast, previously known only from Neah Bay, Washington,

and the Monterey Peninsula, but in our range common in the Coos Bay and Cape Arago regions.

ULVALES

ULVACEAE

ULVA Linnaeus, 1753

As delimited in this study this genus includes those Ulvaceae that are never at any time tubular, and whose fruiting areas are restricted to the blade margins. The original margin of the frond is composed of a few cells (about 3); these marginal cells are no taller than the submarginal cells and the frond is no thicker at the margin than elsewhere. The fronds are broad in relation to height, and the base if cylindrical is shorter than its diameter.

The Oregon species of this genus can be segregated into four groups: (1) narrow branched species decidedly thicker in the center of the thallus than at the dentate margins; (2) broad species with the cells when seen in cross section in the center of the thallus distinctly taller than square, and at least in one (*U. lobata*) the gametes are anisogamous; (3) broad species with the cells in the center of the thallus about square in cross section, and the margin about as thick as the center of the thallus; and (4) species with cells tall in cross section and about the same height throughout, and with juvenile narrowly wedge-shaped thalli that become increasingly broad with age.

KEY TO THE SPECIES KNOWN TO OCCUR IN OREGON

1. Blades narrow or linear, with dentate margins near base..... **U. taeniata**
1. Blades broadly elliptical or ovate or cuneate, with smooth margins..... 2
   2. Blades ovate or broader, often decidedly thinner at margin; if not, cells near the margins square in cross section..... 3
   2. Blades elliptical or cuneate, margins about as thick as the central portion; cells always taller than broad in cross section..... 5
3. Cells at the center of thallus approximately square in cross section; thalli large and expanded, light green in color..... **U. expansa**
3. Cells at the center of thallus taller than broad in cross section; thalli not in a broadly expanded sheet, dark green in color..... 4
   4. Margins of blade about half as thick as center of blade; perforations of blade, if present, irregular and not progressively larger toward the margins **U. lobata**
   4. Margins of blade over half as thick as center of blade; perforations always present, progressively larger toward margin of blade..... **U. fenestrata**
5. Under 3 cm. tall; in dense stands near high tide level..... **U. californica**
5. Over 10 cm. tall; growing in tufts between LHLW and MLLW.... **U. stenophylla**

Ulva taeniata (Setchell) Setchell & Gardner, 1920a:286. *pl. 28*; — Setchell & Gardner, 1920b:273. *pl. 23*; — Smith, 1944:48. *pl. 3, figs. 1–3.*

PLATE 2, FIGS. 11–12; PLATE 4, FIGS. 3–4

Common throughout the range between MLLW and LHLW.

In surface view the cells along the margin are small and close fitting, 7–8 x 8–10 μ, tending to be quadrangular, and often in rows; cells along

the axis of the frond, while still in rows in surface view, tend to be somewhat distant from each other and rounded-polygonal in outline though often elongated parallel to the axis of the blade and up to 14 x 28–32 μ. The axial portion of the frond is up to 95 μ thick just above the rhizoidal region, midway between base and apex usually about 70 μ thick, but near the apex it thins down to 30 or 35 μ. The blades become thinner from the axis toward the margin, where they are from 17–30 μ in thickness. In the rhizoid producing basal region the margins are often somewhat enteromorphoid, but the cells are not in proportion taller than those from the center of the frond.

The blade of the type of *Ulva dactylifera* in the University of California herbarium (*Gardner 1938*) has dentations on the margins and these can also be seen in Setchell & Gardner's illustration of this specimen (1920a, *pl. 26, fig. 1*). It does not seem to be greatly different in any character from some young forms of *U. taeniata* from Oregon.

Ulva taeniata is the only Oregon species with dentate margins and so the only Oregon member of the first section, the section to which *U. fasciata* belongs. In the very youngest specimens seen (*O'Neal 435*, on *Odonthalia* at Seal Rocks, July) the entire margin, including the apical regions, is dentate. From this material it seemed evident that branching of adult thalli results from further proliferation or enlargement of the denticulations, rather than by an increase in size or division of the primary bladelet. As a result the upper portions of older fronds are smooth-margined, with denticulations restricted to the margins near the base.

Ulva fenestrata Postels & Ruprecht, 1840:21. *pl. 37*; — Setchell & Gardner, 1920b:267.

PLATE 2, FIG. 3

Along the coast of Oregon north of Rogue River Reef, usually on small boulders in the bottoms of low-lying, gravel-bottomed tidepools.

At the center of the thallus, as seen in cross section, the cells are from 1.5–3 times as tall as broad. Larger thalli are about 45 μ in thickness, smaller thalli about 70 μ. The largest specimens (*MD 2690*, North Bay; *MD 6222*, Rogue River Reef) are some 40 cm. tall; some small juvenile thalli are about 6 cm. tall (*Wayne Wells 36* and *42*, Coos Bay; *MD 6222*). Other Oregon material, including some of the above Wells collections, seem, by their irregularly arranged perforations and other characteristics, to be forms of either *U. lobata* or *U. expansa*.

Material collected on the Oregon Coast is similar to specimens identified as this species by Setchell and Gardner. Though somewhat less perforate, the Oregon material is similar to the illustrations by Postels and Ruprecht in that the smallest holes are near the center of the blade and these holes become progressively larger toward the margins. At the margins the perforations break open, leaving narrow free blade segments. Specimens of *U. expansa* collected at Monterey (*MD 5666* and others in the Dudley Herbarium) have holes in the thallus, but these are not so progressively arranged according to size, and the blades are never divided into narrow

segments at the margin. It should be noted that the Alaskan specimens in the University of California herbarium are much more fenestrate than those from along the coast of Oregon. *Ulva reticulata* (*Phycoseris reticulata*) as illustrated by Kützing (1856, *pl. 29*) and by material seen in the Dudley Herbarium from Hawaii, is different in that the fenestration divides the thallus into a network of almost linear meshwork and the whole thallus is much smaller.

Ulva lobata (Kützing) Setchell & Gardner, 1920a:284; — Setchell & Gardner, 1920b: 268; — Smith, 1944:46. *pl. 4, figs. 4–5.*

Common from the MLLW-LHLW beaches south of Chetco Cove to Coos Bay and further north at least to Agate Beach. One collection (*H. C. Luce 4*) was dredged in an otter trawl by Clarence Hubbard at a depth of 35 fathoms, 8 miles north off the Coos Bay bar. Since this was mostly on mud and sand bottoms the specimen was very possibly a free floating one.

The largest Oregon specimen is some 150 μ thick near the base, 95 — 100 μ in the center of the thallus above, and 70 μ along the margin; other specimens are from 70 — 95 μ thick in the center, as thin as 25 μ on the upper margins, and 45 μ in thickness along the lateral margins.

Ulva expansa (Setchell) Setchell & Gardner, 1920a:284; Setchell & Gardner, 1920b: 268; Smith, 1944:46.

Only in South Slough were specimens seen which seemed to be this species. These specimens were attached to small rocks and stones in the mud on tide flats. The thalli were up to 20 — 30 cm. broad and perhaps a meter or more long. The South Slough material is similar to a specimen in the University of California herbarium (*Gardner 2086*) from Dillon's Beach, San Mateo County, California. *Ulva lactuca* specimens reported in Sanborn and Doty (*ined.*) are for the most part this species and fragments of very large specimens of *U. lobata*.

Ulva stenophylla Setchell & Gardner, 1920a:282. *pl. 26, fig. 2; pl. 29*; — Setchell & Gardner, 1920b:271. *pl. 21, fig. 2; pl. 24*; — Smith, 1944:47.

PLATE 2, FIGS. 1–2

In Oregon known only from Chetco Cove (*MD 6126*) on LHLW rocks. The Pacific Coast range is south from here to Big Sur, Monterey County, California (latter station based on *MD 4039*, Dani ranch).

This is the only broadly lanceolate (or elliptical) thick, dark green *Ulva*, of large size, known along the coast of Oregon. The smallest (2 — 5 cm. tall) and narrowest thalli are narrowly cuneate and *Enteromorpha*-like. Others are broad and in form not unlike narrow forms of *U. lobata*. From this latter species they differ in being about as thick at the margin as near the center. *Ulva lobata* has a small broad blade increasing in breadth all along the margin, whereas *U. stenophylla* is at first lanceolate and then broadens. The distribution of fruiting areas is unknown. The smallest thalli found intermingled with large thalli have tubular bases or margins similar to those of *Enteromorpha*. Perhaps these small thalli are not the

same species since the large fronds have nothing enteromorphoid about them.

Ulva californica Wille, 1899, *in* Collins, Holden & Setchell, Phyc. Bor.-Amer. fasc. 13:611; — Setchell & Gardner, 1920b:264.

PLATE 2, FIGS. 6–10

Forming patches of low thalli near high tide level; locally abundant from South Bay south throughout the range. The following discussion is based upon these four collections made between South Bay and Moss Beach, San Mateo County, California, as follows: *MD 2277*, South Bay; *MD 6187*, between plus 3.0 and plus 8.0 feet at Otter Point; *MD 6296*, just below and with the lowest *U. vexata* along the north shore of Chetco Cove, July; and *MD 6289*, Moss Beach, San Mateo County, California.

Though thalli of Oregon specimens are for the most part of greater stature than Setchell and Gardner's specimens in the University of California herbarium, other characters indicate that it is this species. These characters are: (1) narrowly cuneate juvenile stages; (2) a short cylindrical stipe that becomes shorter as the holdfast broadens and finally includes a flat marginal section of the blade base; (3) a margin which is about as thick as the center of the thallus; (4) thalli usually less than 2.0 cm. tall, but which sometimes are up to 3 cm. tall; and (5) the habit of growing in small patches on tops and sides of rocks near mean sea level. However, where conditions are favorable, it appears higher, in more or less dwarfed form. While the cells near the rhizoidal portion of mature thalli are in indistinct rows which tend to become irregular, those in the blade are more squarish and in places in very distinct rows. As seen in surface view the cells of the blade are 10 — 12 μ in diameter, though some of the more rectangular ones are 6 — 8 x 10 — 14 μ. The base of the blade is solid and with the cells at the margin arranged in the typical ulvoid manner. Here the center and margin are 55 — 60 μ in thickness and there is no trace of any separation between the two cell layers. The upper portion of the blade is thinner (47 — 50 μ) than the base, but with the same sort of margin. The gelatinous material between the two layers of cells, so often conspicuous in other species, is only very slightly if at all developed in the upper portions of the blade of *U. californica*. Isotype material examined is thinner in cross section, 60 μ in thickness near the base but only 35 — 45 μ in the upper portion. In the broad or more mature thalli the cells are, in cross section, from as broad as tall to one-fourth as broad as tall.

MONOSTROMA Thuret, 1854

Monostroma zostericola Tilden, 1900, *in* North Amer. Algae no. 308; — Setchell & Gardner, 1920b:238. *pl. 14, figs. 12–13*; — Smith, 1944:43.

PLATE 2, FIGS. 4–5

On *Phyllospadix* at all stations from Agate Beach to Brookings.

Most Oregon collections are like Yamada's Japanese specimens from the

Kurile Islands in the University of California herbarium and specimens from Moss Beach, San Mateo County, California (*Gardner 6259* and *4910*; and *MD 6059*). The usual height of Oregon specimens is 1 cm. or less but thalli of one collection (*O'Neal 227*, North Bay) are up to 4.5 cm. tall. The blades as seen in cross section are up to nearly 20 μ in thickness with the cells close together and the height usually more than twice the breadth. In *M. oxyspermum*, the other species along the Oregon coast, the cells are usually as broad or broader than tall and often remote from each other.

Monostroma oxyspermum (Kützing) comb. nov.

Ulva oxysperma Kützing, 1843:296; — Kützing, 1849:474.
Ulva latissima Kützing, 1843:296; — Kützing, 1845:244; — Kützing, 1856:7. *pl. 14.*
Monostroma latissimum (Kützing) Wittrock, 1866:33. *pl. 1, fig. 4*; — Setchell & Gardner, 1920b:241.
Ulva oxycocca Kützing, 1845:244; — Kützing, 1849:474.
Monostroma oxycoccum (Kützing) Thuret, 1854b:29; — Wittrock, 1866:32; — Hamel, 1931:54.
Monostroma laceratum Thuret, 1854b:32.
Monostroma orbiculatum Thuret, 1854c:388; — Setchell & Gardner, 1920b:242.
Ulva quaternaria Kützing, 1856:6. *pl. 13, fig. 2.*
Monostroma Wittrockii Bornet (*fide* Hamel, 1931).

PLATE 2, FIGS. 13–15

Common in Coos Bay and other bays in the range. In brackish water and in a fresh water lake in the sand of Chetco Cove.

Monostroma orbiculatum, *M. latissimum* and *M. quaternarium* are considered to be distinct species by Setchell & Gardner (1920b), but they had doubts as to the separability of the three. Study of sections of Pacific Coast specimens of these species as determined by Setchell & Gardner leads to the conclusion that they are but forms of one species. Their *M. orbiculatum*, the largest (*i.e.*, up to 30 x 40 cm.) and the thickest (up to at least 40 μ thick), is very light in color and some specimens are nearly colorless as though in poor health or senescent. The only West Coast specimens are from San Francisco Bay and an annotation by Collins on one (*Setchell 1255*) says, "I do not feel certain, but still think on the whole, correct, F. S. C." *Monostroma latissimum* as known on the West Coast is intermediate in nature between *M. orbiculatum* and *M. quaternarium*, and presumably differs from the latter in the arrangement and shape of the cells. In *Enteromorpha* and *Ulva* apparently this surface appearance of the cells is somewhat correlated with age and it seems that the same phenomenon is at play here in *Monostroma*, as shown by the collections investigated.

Hamel (1931:51) unites the three in a single species. He selected Kützing's name *oxycocca*. Kützing cites (1845:244) his earlier validly published name, *Ulva oxysperma*, as a synonym of his *Ulva oxycocca*, presumably because he considered *oxycocca* a more appropriate name. This is contrary to the International Rules; the earliest legitimate epithet for the entity must be chosen, and this is *Ulva oxysperma* Kützing (1843:296)

insofar as this author is aware. The synonymy cited above for European species is taken for the most part from Hamel's and from Wittrock's papers.

ENTEROMORPHA Link, 1820

The most reliable criterion for distinguishing between this genus and *Ulva* is the character of the blade margin. In *Enteromorpha* the margins are composed of more than three cells and these cells are as tall as, or taller than, those nearer the center of the thallus. Usually the margins are hollow or with the gelatinous material between the cell layers distinctly thickened. In *Ulva* the margins are composed of about three cells, the proportions of which are about the same as those of the submarginal cells. The margins of the blades of *Ulva* are neither hollow nor with a thickening of the gelatinous material between the two cell layers.

KEY TO THE SPECIES OF *ENTEROMORPHA* KNOWN FROM OREGON

1. Thalli broadened above with the two cell layers adhering to each other; unbranched 2
1. Thalli narrowed above or tubular throughout; usually branched 5
   2. Many of the cells in cross section as tall as, or taller than, broad; upper portion of blades over 20 μ thick 3
   2. All cells in cross section broader than tall; upper portion of blades under 20 μ thick ..... **E. linza**
3. Usually infected with fungi and the margins not hollow, if uninfected only the margin tubular; the stipe compressed, with the cell layers adhering throughout ..... **E. vexata**
3. Never infected with fungi; margins of blade and base of stipe tubular 4
   4. Blade light green; stipe short (up to 2 cm. long), linear, abruptly broadened above and compressed; blade usually under 50 μ thick, the cells often broader than tall in cross section ..... **E. angusta**
   4. Blade dark green; the stipe long, narrowly cuneate, and gradually broadening above; blade usually over 50 μ thick, with the cells taller than broad in cross section ..... **E. linza**
5. Cells in surface view regularly under 10 μ in any dimension ..... **E. minima**
5. Cells in surface view regularly over 10 μ in one dimension 6
   6. Cells, except in basal portion, not arranged in rows 7
   6. Cells arranged in rows throughout entire thallus 8
7. Thallus tubular; membrane over 20 μ thick, with cells nearer the outer surface **E. intestinalis**
7. Thallus compressed; cell membrane under 20 μ thick, with the cells in the center **E. compressa**
   8. Surface view of cells in the main axis under 20 μ in either dimension; bases of branches attenuated, filament-like; tips of branches inflated as in the main axis ..... **E. prolifera**
   8. Mature cells with 2 — 5 pyrenoids; cell rows usually about 20 μ broad; cells not strongly thickened at their adjoining angles ..... **E. clathrata**
9. Mature cells with 1 pyrenoid; cell rows usually about 10 μ broad; cells often strongly thickened at their adjoining angles ..... **E. Ahlneriana**

Enteromorpha intestinalis (L.) Link, 1820:5; — Setchell & Gardner, 1920b:252; — Smith, 1944:49. *pl. 5, figs. 4–6.*

A number of collections have been made between the mouth of the Nehalem River and Brookings. Two (*MD 6136c*, fresh lake in beach of Chetco Cove; and *6219*, Otter Point) are the variety (form) *clavata* of J. Agardh. *Enteromorpha intestinalis* is found along high-tide line near fresh water sources, on rocks near seepages or near the mouths of rivers and creeks.

Distinguished from other species found along the Pacific Coast of North America by the irregular arrangement of cells and by the cells lying nearer the external surface of the membrane. Kylin (1907:7) states that this latter characteristic serves as a ready distinction between this species and *E. compressa*, the membrane of which is at times slightly thicker on the inner face. In addition, the membrane in *E. compressa* is usually thinner (under 20 μ thick).

Enteromorpha compressa (L.) Greville, 1830:180. *pl. 18*; — Setchell & Gardner, 1920b:251. *pl. 14, figs. 7–8*; *pl. 16, fig. 3*; — Smith, 1944:52. *pl. 5, fig. 7.* (Both in part)

Thalli light green, with many narrow oblanceolate branches arising from constrictions in the narrow oblanceolate main axis; up to 30 cm. tall, the upper portion of the branches up to 5 mm. broad; inflated in some areas but mostly compressed, cells thin-walled, squarish or elongate in surface view, up to 16.5 x 18 μ, in longitudinal rows in the narrowest portions of the stipe; above this the cells are rounded to polygonal, irregularly arranged, about 16 μ in diameter with the membrane up to 8 μ in thickness and with the cells in its center.

Throughout the range, the largest and most proliferous thalli (*e.g.*, *MD 4853*, Charleston) most abundant on woodwork in protected habitats. In these thalli the cells are in well-defined rows both in the stipes and narrower portions of the blade. Thalli with few or no branches may have the cells irregularly arranged except in the lowermost two centimeters (*O'Neal 252*, Coos Bay; University of California herbarium collected by A. R. Sweetser (*5*) at Seal Rocks and determined by Setchell). Gardner, *2766*, made a collection of this species from the entrance to Coos Bay that has been referred by Setchell & Gardner (1920b:252) to the variety *subsimplex* J. Agardh.

Enteromorpha prolifera (Müller) J. Agardh, 1883:129. *pl. 4, figs. 103–104*; — Setchell & Gardner, 1920b:254; — Taylor, 1937: 65. *pl. 3, fig. 2*; — Bliding, 1939:134. *figs. 1–3.*

Thallus dark to light green; with a distinct main stem which is either simple and often broad, or more or less richly proliferous; stipes usually attenuated to filament-like proportions basally; cells 8–18 x 7–13 μ, cells in the lower portions of the thalli mostly squarish or rectangular in surface view, cells in the proliferations in distinct, often oblique, rows that become less distinct in the upper parts of the main axes and where too the cells become more rounded-polygonal, with one central pyrenoid; mem-

brane 14–18 μ thick; male gametes 5.7–2.2 μ; female gametes 6.2 x 2.9 μ; zoospores 9.1 x 4.4 μ (average sizes for all three).

Throughout the range in a confusing array of forms. In general this species is distinguished by having inflated or tubular fronds with the cells in rows, the cells centrally located in the membrane, smaller than those of *E. compressa*, with very thin walls, and the stipes not at all "attenuated" as compared to those of the most branched forms of *E. compressa*. There is a collection in the University of California herbarium (*Gardner 2767*) from North Bend that macroscopically seems more like a proliferous specimen of *E. intestinalis* or *E. compressa*. Another Oregon collection (*MD 4915*) has tubular coiled or flexuose thalli up to 5 cm. long — this was collected from an almost fresh-water pool at the plus 8.0 foot level along Coos Head in July.

On the basis of interfertility and intergradation of forms found in Scandinavian waters, Bliding combines *E. prolifera* (Fl. Dan.) J. Agardh, *E. flexuosa* (Wulf.) J. Agardh, *E. tubulosa* Kützing, *E. intestinalis* (L.) Link forma *prolifera* Hauck, and *E. compressa* (L.) Ahlner; — *non E. compressa* (L.) Greville. His opinion is followed here except that *E. flexuosa* is considered a distinct variety of *E. prolifera*. The above description is taken in part from Bliding's paper.

Enteromorpha prolifera var. **flexuosa** (Wulf.) comb. nov.

Enteromorpha flexuosa (Wulf.) J. Agardh, 1883:126; — Setchell & Gardner, 1920b:255; — Taylor, 1942:13.

Enteromorpha compressa var. *flexuosa* (Wulf.) Hamel, 1931:65.

Thalli simple, inflated, up to 2 cm. tall; cells in irregular rows, averaging 11 μ in diameter, rectangular, centrally located in the cell membrane which is about 9 μ thick; cell walls very thin.

At MLLW and above on sloping, exposed rocks at Sunset Bay. The determination of *MD 4840* has been confirmed both by Bliding and by Sjöstedt.

Enteromorpha Ahlneriana Bliding, 1944:345. *figs. 10–18.*

Enteromorpha crinita Setchell & Gardner, 1920b:258 in part; *non* (Roth) J. Agardh.

Thallus dark to pale green; varying from profusely and finely branched narrow forms to sparingly branched broad forms; 2–40 cm. high; cells in longitudinal rows and, sometimes, in transverse rows, from about 30 x 10 to about 23 x 10 μ, rectangular and for the most part with rounded corners, cell walls often strongly thickened, chromatophores as a rule well-developed though sometimes small, on an average only one large pyrenoid per cell; alternation of generations unknown; the 4-flagellate zoospores about 9.2 x 3.8 μ.

The above description is based for the most part on the original by Bliding and upon a collection (*Gardner 2730*, North Bend) determined by Bliding as this species. Another collection (*MD 2739*) was obtained from the south jetty of the Nehalem River.

Enteromorpha clathrata (Roth) Greville, 1830:181; — Setchell & Gardner, 1920b: 260; — Bliding, 1944:331. *figs. 1–9.*

Enteromorpha erecta (Lyngbye) J. Agardh, 1883:152; — Setchell & Gardner, 1920b:259.
Enteromorpha plumosa Kützing, 1843:300. *pl. 20, fig. 1*; — Setchell & Gardner, 1920b:259.
Enteromorpha crinita Setchell & Gardner, 1920b:258.
Enteromorpha salina Setchell & Gardner, 1920b:257.

Thalli pale to dark green, especially at the base, richly and mostly finely branched; branches hair-like or broader, with monosiphonous or polysiphonous apices; cells arranged in longitudinal rows, those in the main axis very large, from about 20 x 30 μ–20 x 50 μ, rarely only about 8 x 13 μ; cells in the lateral branches quadrate or rectangular; chromatophore usually small in proportion to size of cell; usually with 2–5 pyrenoids in mature cells; alternation of generations present; biflagellate male gametes averaging 2.5 x 5.5 μ; biflagellate female gametes averaging 2.8 x 6.3 μ; quadriflagellate zoospores averaging 4.3 x 9.8 μ, often with 2 pyrenoids.

Throughout the range in a wide variety of forms.

The above description is taken for the most part from Bliding's paper.

On the Pacific Coast Setchell & Gardner recognized three species (*E. crinita*, *E. erecta*, and *E. plumosa*) which they thought differed from *E. clathrata* in the character of the young branches and in the extent to which the chloroplasts covered the cell surfaces. In accordance with the age of the thallus or the effect of its physiological condition upon its morphology, different parts of the same thallus of *E. clathrata* may be referred to either *E. crinita*, *E. erecta*, or *E. plumosa*. Such has been found to be the case in the collection *MD 2756* (beach north of the Siuslaw River) and *O'Neal 447* (lower Coos Bay).

This species begins its development as attached delicate tufts, quite *Cladophora*-like in nature, in the bays or in other sheltered waters. As these tufts grow larger and mature they break away from their substratum and develop into free floating masses which are often several yards in extent; drifting together in large entangled masses, they often become caught about the piling in bays and river mouths. The masses may become freed, washed out to sea, and eventually cast ashore on open ocean beaches.

All stages described above have been found along the Oregon coast. The youngest material collected (*MD 4113*, Middle Bay in January) formed a low, 0.5 cm. tall, bunchy, coating on the sides of shallow tide pools in sedimentary rocks protruding near the plus 10.0 foot tide level. These were intermingled with strands of *Ulothrix implexa*. Free-floating fronds have been collected in later seasons from at least as far north as the Nehalem River, in Coos Bay, and at the Rogue River Reef (*MD 6221*). The major branches of this form are frequently a millimeter in diameter. In the Nehalem River collection there were areas in some filaments where the cells were filled with bodies thought to be immature swarmers.

Enteromorpha minima Nägeli *in* Kützing, 1849:482; — Kützing, 1856:16. *pl. 43, fig. 3* (of type); — Sjöstedt, 1939:18. *fig. 1* (figures and description of type); — Bliding, 1938:84 ff. *figs. 1–6*; — Ahlner, 1877:48; — Setchell & Gardner, 1920b: 250; — Smith, 1944:50. *pl. 5, fig. 8.*

Enteromorpha micrococca Kützing, 1856:11. *pl. 30, fig. 2*; — Sjöstedt, 1939:21. *fig. 2* (of type); — Setchell & Gardner, 1920b:249; — Smith, 1944:50.

Enteromorpha nana Sjöstedt, 1939:35.

Enteromorpha nana var. *minima* (Nägeli) Sjöstedt, 1939:38.

PLATE 3, FIGS. 1–4

Thalli unbranched; yellowish green to dark green; inflated, 0.5–2.0 cm. high or rarely up to 7 cm. when growing in protected localities, and usually less than 2 mm. broad; cells rounded polygonal, 5–7 μ in diameter, with one pyrenoid, centrally located in membranes less than 10 μ thick but in thick membranes (over 10–16 μ) somewhat nearer the outside, usually irregularly arranged, but in tall narrow forms in irregular rows or irregular spiralled rows; sexual reproduction unknown; asexual reproduction by means of quadriflagellate zoospores approximating 5.5 μ in length, without a stigma and not phototactic; juvenile thallus becoming a plate of cells two cells thick in the center, from which the adult thalli arise as one or a few proliferations.

Common on high surf-swept rocks and on mussel shells (*Mytilus* spp.) throughout Oregon.

Kützing described *E. minima* in 1849 and *E. micrococca* in 1856. Ahlner, the next phycologist to monograph the genus, reversed the names when redescribing Kützing's two species and this error has persisted in phycological literature until Sjöstedt re-examined the types of Kützing's species in 1939. Both species have been recognized by Collins and other American phycologists. With respect to these two species, I have followed the opinion of Bliding who holds that they are but one species. The identification of *MD 4992* as *E. minima* has been confirmed by Bliding, and by Sjöstedt under the name *E. nana*.

Enteromorpha minima var. **subsalsa** (Kjellman) comb. nov.

Enteromorpha micrococca f. *subsalsa* Kjellman, 1883:359; — Setchell & Gardner, 1920b:249. *pl. 16, fig. 1.*

Enteromorpha nana var. *subsa'sa* (Kjellman) Sjöstedt, 1939:53.

Enteromorpha clathrata f. *uncinata* Kjellman, 1877:44; — Kjellman *in* Wittrock & Nordstedt, Alg. Exsicc. 131.

Enteromorpha arctica J. Agardh, 1882–1883, *pro parte, fide* Sjöstedt, 1939:53.

Enteromorpha minima var. *rivularis* Collins, 1909b:201.

In creek mouths throughout the range from Short Sand Beach (*MD 2721*) to Chetco Cove.

The cells of Oregon specimens are irregularly arranged, the cell lumina rounded in outline and 6–9 μ in one dimension, though sometimes narrower in the other. The cell lumina are nearer the outer surface of the membrane which is usually at least 12 μ thick. There are numerous irregularly arranged compressed blunt branches with very broad bases — but the branching is not confined entirely to the margins. The chloroplast does not cover

the cell surface completely when herbarium material is remoistened. It seems identical with Kjellman's description (1883) and figure (Plate 31, Figs. 1–3). Both Drs. Sjöstedt and Bliding have confirmed the determination of *MD 2721*.

Enteromorpha linza (L.) J. Agardh, 1883:134. *pl. 4, figs. 110–112.*
Ulva linza Setchell & Gardner, 1920b:262; — Smith, 1944:44. *pl. 3, figs. 4–5.*

PLATE 1, FIGS. 7–9

Common throughout the range in one form or another.

Bliding (1939:140), and earlier J. Agardh, pointed out that *U. linza* is distinguishable from other narrow unbranched species of *Ulva* and *Enteromorpha* by the arrangement of the cells in rows near the base, and Bliding adds that the swarmers are always four-flagellate zoospores. In other related species the cells are irregularly arranged and the swarmers are biflagellate. *E. linza* is to be differentiated from *E. angusta* by its thinner blades, proportionally broader cells, and simpler, less plicate frond (except some *E. linza* var. *crispata*). The varieties of *E. linza* having blades as thick as those of *E. angusta* are differentiated by their shape, color, and in habitat.

At the time Linnaeus established the name "linza" as the specific name there was no genus after which it could have been taken. He refers to Johann Bauhin's *Historia plantarum universalis*. . . . 1650–1651, vol. 3, p. 801 (not p. 81 or otherwise as usually cited). Here *Fucus linza* is described in a small paragraph at the bottom of the upper half of the right hand column as follows: "Fucus Linza dictus Lactucae marinae similis," as a centered italicised heading, followed by: "Fucus Linza dicta, Lactucae marinae similis: sed in eo differt quod tota in fascias (Linze) longas diuisa sit, eodum Imper. authore cap. 12." The capitalization is as in the original. Insofar as the author has been able to ascertain by consultation with Italian, Greek, and Latin philologies he has found no justification for the capitalization of this specific name. There is no indication in the original or elsewhere that it might be a patronym.

KEY TO THE VARIETIES OF *E. LINZA* FOUND IN OREGON

1. Upper portion of blades usually less than 15 μ thick; cells up to 3 or 4 times as broad as tall in cross section 2
1. Upper portion of blades usually over 25 μ thick; cells not more than twice as broad as tall in cross section ..... **E. linza** var. **oblanceolata**
   2. Blade linear, marginally plicate ..... **E. linza** var. **crispata**
   2. Blade linear to narrowly elliptical-oblanceolate, margin not plicate 3
3. Stipe straight ..... **E. linza** var. **lanceolata**
3. Stipe flexuous or coiled ..... **E. linza** var. **flexicaulis**

Enteromorpha linza var. **lanceolata** J. Agardh, 1883:134.

PLATE 1, FIGS. 7–9

Throughout the range, on rocks between LHLW and MLLW.

The Phycotheca Boreali-Americana number 16, from volume 1, in the

herbarium of W. R. Taylor as numbered 10389, and elsewhere, annotated by W. A. Setchell, has, in addition to the narrowly linear form with the narrow cuneate bases, low broad cells in the upper regions and there the whole blade is 18 μ or less thick. Though small in stature, this seems to represent well the conception of the variety as understood on the Pacific Coast.

Enteromorpha linza var. **crispata** J. Agardh, 1883:134.

Throughout the range, epiphytic and on rocks between LHLW and MLLW.

This variety has been collected (*O'Neal 450*) on the beach near Charleston, in not greatly different habitats from the variety *lanceolata* (*e.g.*, *MD 4630*) growing nearby.

Enteromorpha linza var. **flexicaulis** var. nov.

Frondes simplices, inflatae, lineari-oblanceolatae, usque ad 0.6 cm. latitudine atque 35 cm. longitudine, subvirides, stipitibus attenuatis helicoideis praeditae; membranae supra tenuissimae, quarum stratis duobus simul ab 3–7 μ crassitudine, e cellulis infra in ordinibus indefinitis, et in regionibus apicalibus, vel maximis, in ordinibus irregularibus compositis; infra membranae simul usque ad 25 micra crassitudine, cellulis fere quadratis; cellulae a superficie visae ab 11–14 x 12–19 μ et, regionibus basalibus exceptis, magna ex parte breviores quam 3 plo latiores quam altae, inter superficies membranae internas atque externas propemodum centraliter positae; regio fertilis solum ad apicem et superficies marginales in triente superiore thalli limitata.[3]

Fronds simple, inflated, linear-oblanceolate, up to 0.6 cm. broad and 35 cm. long, light green in color, with attenuated coiled stipes; membranes above very thin, the two layers together from 3–7 μ thick, composed of cells in definite rows below and in irregular rows even in the largest apical regions; below the membranes may together be 25 μ thick with the cells almost square; the cells are in surface view from 11–14 x 12–19 μ and in almost all cases lower than 3 times as broad as tall except in the basal regions, approximately centrally located between the inner and outer surfaces of the membrane; fruiting area confined to tip and marginal areas in the upper third of thallus.

Two collections (**TYPE:** *MD 4622*, Old Dock in Coos Bay, July 2, 1942; **COTYPE:** *MD 4991*, North Bay, July 28, 1942) have been made from rocks in relatively protected areas along the Oregon Coast. In the University of California herbarium there are several collections (*Minnie Reed 487*, *312*, and *452*) from the Hawaiian Islands that are the same, at least superficially.

Enteromorpha linza var. **oblanceolata** var. nov.

PLATE 1, FIGS. 10–11; PLATE 8, FIG. B

Frondes oblanceolatae usque ad 13 cm. altitudine per 5 cm. latitudine; stipes tenuis, tubularis aut stratis cellularum adhaerentibus; cellulae a sectione transversa visae

[3] The author is indebted to Dr. Hannah Croasdale of Dartmouth College for the Latin diagnoses.

ubique altiores quam latae, et cellulae in marginibus altiores quam illae in centro laminae; frondes in apice 45–65 μ crassitudine.

Fronds oblanceolate up to 13 cm. tall by 5 cm. broad; stipe slender tubular or with cell layers adherent, but if so then with many cells (5–6) forming the margin which is thicker than the center and with a small empty or gel-filled space between the cell layers; cells taller than broad throughout and those at the margins taller than those in the center of the blade; apically the fronds are 45–65 μ thick in the type.

TYPE: *Orla R. O'Neal 433* (Dudley Herbarium 306409), collected at Seal Rocks, Lincoln County, Oregon, VII–8–'44; epiphytic on *Gymnogongrus linearis* and there associated with *Phaeostrophion irregulare*.

This is one of the entities to be found in herbarium folders labeled *E. linza* and as yet to be distinguished chiefly by the shape of the thallus. Specimens examined from elsewhere along the Pacific Coast and from the East Coast are quite variable in the thickness of the membrane. In some of the largest specimens the cells may be square or in the thinnest parts a little broader than square. While our specimens are thick as indicated in the description above, other much larger material (*W. A. Setchell & H. E. Parks*, Sooke Harbor, Vancouver Island, B. C., June) of the same general superficial appearance was only 19 μ thick near the apex. Here none of the cells were broader than twice their height. Other large material sectioned was at the thinnest above some 35–45 μ thick, with cells cuboidal or taller.

Of a portion of the type, Sjöstedt, in a personal communication, says, "possibly it is identical with the original *Ulva lanceolata* Linne (but not identical with the *lanceolata* of later authors!!). The type is as yet not distinctly described." The punctuation and parentheses are his. It is to be hoped that perhaps Sjöstedt will publish a careful study of this Linnean species in the near future, for he says this same form is very much like some of the smaller plane forms of *E. linza* found, sometimes intermixed, on Swedish coasts.

Enteromorpha angusta (Setchell & Gardner) comb. nov.

Ulva angusta Setchell & Gardner, 1920b:283. *pl. 27; pl. 31, fig. 1*; — Setchell & Gardner, 1920b:264. *pl. 22; pl. 26, fig. 1*; — Smith, 1944:45. *pl. 4, figs. 1–3.*

PLATE 1, FIGS. 1–6

Known from Oregon by the following collections: *MD 2728*, Oceanside; *MD 2645*, Boiler Bay; *MD 2701* and *O'Neal 443*, both lower Coos Bay; *O'Neal 210*, North Bay; *MD 6294*, Otter Point; *MD 6217*, Brookings, washed in on a *Nereocystis* stipe.

Setchell and Gardner give "Moss Beach, San Mateo County, California. . ." as the type locality. Near the northern end of this Moss Beach there are two or three large wave-cut rocks associated with a curved reef. The author in searching for topotype material of this species thoroughly covered this collecting area from the northernmost accessible portion south for about one mile. *Enteromorpha angusta* was found only in the area

immediately south of these large rocks and it is assumed that this must be the type locality. The alga was growing in tufts around the tidepool edges and along the edges of gravelly rills between the LHLW and MLLW levels. The particular locality is protected from rough water.

Sections of an isotype show that the margins are sometimes tubular. Specimens from Oregon agree with the type material and this topotype material in macroscopic and microscopic details as well as in habitat. In the topotype material (*MD 6058* and *6049*) there are thalli with flat stipes, stipes with hollow or thickened margins, and stipes that are tubular. Many of them have cylindrical tubular stipes up to 2 cm. in length; others have only a narrowly cuneate flattened base superficially ulvoid in nature. The margins of the blade are usually *Enteromorpha*-like but in the tallest forms the margins become more ulvoid, but still are usually slightly thicker than the center of the thallus. An ulvoid margin describes the natural edge of a thallus formed by about 3 or less cells no taller in cross section than those in the submarginal areas: an *Enteromorpha*-like margin is descriptive of the natural edge of a thallus when formed by over 3 cells which in cross section are as tall or taller than the submarginal cells. An ulvoid margin is apt to be thinner than, or of the same thickness as, the rest of the thallus, but enteromorphoid margins are thicker than the submarginal region of the thallus.

As seen in cross section, cells in the base are approximately three times as tall as broad; whereas those in the upper portions of the blades are usually only slightly taller than broad. The upper part of the thallus of the topotypes is 21–35 μ thick. In the isotype material sectioned it was 45–50 μ thick. In surface view the cells are polygonal and sometimes in irregular rows. In cross sections of all Oregon specimens the breadth of cells is no more than double their height in any part of the thallus. The thickness of Oregon specimens varies from 20 to 50 μ but usually ranges between 25 and 35 μ. The thickness of the terminal portions of fronds and the cell shape in cross section distinguish this species from *E. linza*.

Enteromorpha vexata (Setchell & Gardner) comb. nov.

Ulva vexata Setchell & Gardner, 1920a:282. *pl. 22, figs. 4–7*; — Setchell & Gardner, 1920b:271. *pl. 17, figs. 4–7*.

Ulva californica Reed, 1902:142ff. *pl. 15* (*non* Wille).

PLATE 1, FIGS. 12–14

On the north shore of Chetco Cove (*MD 6114*) on just one boulder in July and forming a 2–foot zone running up through the upper 6 inches of the barnacles and on above to plus 8.0 or 9.0 foot tide levels (probably near LLHW); Coos Bay (*Wayne Wells 38*); Squaw Island (*MD 4140*), just above and with the highest *Porphyra*. Only the Chetco Cove specimens were infected with a fungus.

In the herbarium of Professor Wayne Wells there is a collection of a small ulvoid alga from Coos Bay which Setchell determined as this species.

Duplicates of this are in the University of California herbarium and in the author's collection. There are two or three collections from our range and south of it in the author's collection that seem to belong here except that they are without trace of fungous infection. A collection of typical infected material was obtained in which there were a few only slightly infected thalli with the same morphology as uninfected thalli, and these bridge the gap between the infected and uninfected plants.

Sections of the base of the isotype material were swollen and appeared, as did the margin, as though this would be tubular if it were not for the filling by fungous hyphae. Cells at the margins of this material are arranged in typical enteromorphoid style and are taller than those on the flat surface of the thallus. The uninfected collections always possess thalli in which tubular enteromorphoid margins can be found.

SCHIZOGONIALES
SCHIZOGONIACEAE

PRASIOLA Meneghini, 1838

Prasiola meridionalis Setchell & Gardner, 1920a:291. *pl. 25, fig. 2*; — Setchell & Gardner, 1920b:278. *pl. 20, fig. 2*; — Smith, 1944:53. *pl. 2, figs. 10–15.*

This species grows in large patches or bands on the bird-dung bespattered offshore rocks along our coast from Puget Sound to the Monterey Peninsula. The bands are often five to ten feet broad extending upwards from the highest tide levels. Growths of this species are particularly lush on portions of the rocks least exposed to desiccation and most exposed to spray, thus suggesting that these two factors are additive. While these green bands have been observed in our range on offshore rocks, the only actual collection was one small thallus found incidentally in beach wash south of the mouth of the Chetco River.

CLADOPHORALES
CLADOPHORACEAE

CLADOPHORA Kützing, 1843

Cladophora delicatula Montagne, 1850:302; — Setchell & Gardner, 1920b:220; — Smith, 1944:61.

PLATE 4, FIG. 2; PLATE 3, FIGS. 5–7

Known only from a single collection (*Gardner 2747*) bearing the annotation, "Growing on sound rock in a sheltered shady place near high tide, North Bend, Oregon. May, 1914."

This species is distinct from all others in the method of development of trichotomous branches. While this method does not always obtain, it is common in all the material examined. The illustration was drawn from a part of Gardner's collection.

Cladophora hemispherica Gardner & Collins, *apud* Collins, 1918:83; — Setchell & Gardner, 1920b:209; — Smith, 1944:57.

PLATE 4, FIG. 1

Known in our range only from South Cove.

All specimens identified by Setchell & Gardner as this species are from central California. Along the Oregon coast there seems no clear distinction between this species and *C. trichotoma*. However, a lower, more closely tufted, sand-free, dichotomous form with smaller branches is considered this species. On Cape Arago it grows at higher levels and in more exposed situations than does *C. trichotoma*. None of the Oregon specimens is over 1.5 cm. tall and very few branches are over 135 μ in diameter. The lowermost cells of the thallus (*MD 2696*) are up to ten times as long as broad. The apices of the branches are short-acute. Similar material has been collected near the type locality (Cypress Point, Monterey Peninsula, California). The figures have been drawn from a portion of Gardner's collection *4620* made at Moss Beach, San Mateo County, California. The often swollen abaxial surface of the branch base is a feature distinctive of this alga (see figure).

Cladophora trichotoma (C. Agardh) Kützing, 1849:414; — Setchell & Gardner, 1920b:210. *pl. 16, fig. 2*; — Smith, 1944:58. *pl. 7, fig. 2.*

This *Cladophora* is abundant at all stations along the coast and is identifiable in the field by the size (2–4 cm. tall) and its hemispherical, usually somewhat sand-choked, tufts which grow between HHLW and LHLW.

A very coarse wiry form is present around high-lying tidepools and at similar heights in moisture-retaining crevices. This (*e.g., MD 4159*) seems distinct from all other species of *Cladophora* described by Setchell & Gardner, but since the species of *Cladophora* are so poorly understood it is felt best to consider this merely a form of *C. trichotoma* rather than a new and distinct entity. It forms loosely tufted mats 1 or 2 cm. in thickness; all branches are straight and of about the same diameter; the cells are up to 270 μ in diameter and 2.5–3 diameters in length.

Cladophora gracilis (Griffiths & Harvey) Kützing, 1845:215; — Taylor, 1937:89. *pl. 5, figs. 1–2, 6–7.*

One collection (*O'Neal 243*) from the old jetty at the mouth of South Slough is undoubtedly this species.

The largest filaments are 150 μ in diameter with the cells up to 300 μ (or perhaps more) in length. The branching is not at all opposite or dichotomous, but alternately two or three times unilateral. The tips are subacute with the smaller ramuli incurved.

Cladophora microcladioides Collins, 1909a:17, *pl. 78, figs. 2–3*; — Setchell & Gardner, 1920b:212. *pl. 13, fig. 2*; — Smith, 1944:59. *pl. 7, fig. 3.*

Setchell & Gardner list this species as ranging from Vancouver Island to San Diego. Only a single small collection by Mrs. H. B. Yocom from Coos Bay admits this alga to the flora.

SPONGOMORPHA Kützing, 1843

Spongomorpha coalita (Ruprecht) Collins, 1909b:361; — Setchell & Gardner, 1920b: 230. *pl. 16, fig. 4*; *pl. 32*; — Smith, 1944:65. *pl. 6, fig. 1.*

This is the most abundant and constantly present filamentous green alga throughout our range.

Spongomorpha Mertensii (Ruprecht) Setchell & Gardner, 1920a:280; — Setchell & Gardner, 1920b:227.

PLATE 6, FIGS. 10–12

On *Phyllospadix* at North Bay (*MD 5059*) and in a tidepool at South Bay (*MD 2283*). This species has also been collected at Coos Head (*MD 2010*).

This species, other than *S. coalita*, is the only Pacific Coast *Spongomorpha* with compound hooked branchlets. Oregon material compares well with specimens determined by Setchell & Gardner and is to be distinguished from *S. coalita* not only by its blunter branch tips but also by the less branched and less entangled nature of the whole frond. In addition, at least one collection has the young branchlets stiffly erect from their origins, so that they are, within the length of the lowermost cell, bent parallel to the parent filament. While the branches are initiated from the upper ends of cells in the main filament these cells continue to lengthen apically so that soon the older lateral branches seem to have arisen from the middle portion of the cell. In many cases the hooked branchlets in older parts of the thallus seem to have arisen, then, below the middle of the parent cell. Sometimes the branching is opposite with the branches unequal.

Spongomorpha saxatilis (Ruprecht) Collins, 1909b:360; — Setchell & Gardner, 1920b:226.

Only one collection known from Oregon (*MD 2003*, South Bay).

The Oregon collection fits well the description given by Collins. The filaments are near 90 μ in diameter, often oppositely branched, with the branches somewhat acute and not hooked.

Spongomorpha duriuscula (Ruprecht) Collins, 1909b:356; — Setchell & Gardner, 1920b:225.

The one collection (*MD 2645*, Boiler Bay, July) resembles *S. hystrix* in forming a low indefinitely limited mat. The cells show rather distinct longitudinal striations with the branching predominantly unilateral to irregularly alternate. The cells are up to 225 μ in diameter and 2.5–3 times as long as broad. There are no hooked or spiny branches and the tips are blunt. For these reasons the collection has been identified as *S. duriuscula* rather than as a form of *Cladophora trichotoma*, even though its mat-like thallus is atypical.

Spongomorpha spinescens Kützing, 1849:418; — Kützing, 1854:16. *pl. 75*; — Setchell & Gardner, 1920b:229.

PLATE 5, FIGS. 1, 5–6

There are four collections from the coast of Oregon: *MD 4550*, Sunset Bay; *MD 6295*, Rogue River Reef; *Wayne Wells 29*, Coos Bay; *MD 2011*, South Bay.

The main axes have gradually enlarged blunt tips, many acutely tipped spiny branches below and a few simple hooked branches; the tips of secondary axes are mostly blunt but some are spiny tipped. The filaments are up to 160 μ in diameter at the tips and the branching is alternate or secund. The rhizoids are often acutely tipped and on the longer ones there are lateral branches. Cells in the basal portion of main filaments are 1.5–2 times as long as broad, above this up to 4 diameters long, and those in the apical region may reach a length of 10 diameters. Cells below the tips are in irregular pairs indicating intercalary cell division. While the specimens are considerably coarser than usual for the species, examination of a considerable amount of each collection has shown no branched hooked-branchlets, and there are always the spiny, acutely tipped, lateral branches and the main branches with the enlarged blunt tips characteristic of this species.

RHIZOCLONIUM Kützing, 1843

Rhizoclonium tortuosum (Dillwyn) Kützing, 1845:205; — Setchell & Gardner, 1920b:185; — Smith, 1944:62.

Collected at Coos Bay by Mrs. H. B. Yocom, and entangled with *Rhodomela larix* along the north shore of Chetco Cove (*MD 6118*, July).

Rhizoclonium riparium (Roth) Harvey, 1849:238; — Setchell & Gardner, 1920b:182; — Smith, 1944:63. *pl. 7, fig. 4.*

The presence of this species in our range (Sanborn & Doty, *ined.*) is based on somewhat questionable records, for while several of our collections fulfill the requirements of this species, there seems to be perhaps little real difference between this and the following three species.

The species grows along the highest tide lines on banks and cliffs. In such places Setchell & Gardner report it to form "skein-like masses." *Rhizoclonium implexum* (Dillwyn) Kützing may be a form of this species growing attached in more strictly aquatic habitats, habitats favorable to more rapid growth, the production of fewer and simpler rhizoids, and the formation of larger cells in straighter filaments. Many of the specimens in the folder of the University of California herbarium consist of erect rather parallel filaments 10–15 cm. high that evidently grew attached. Setchell & Gardner's *R. lubricum* may be a form of this species also, a form which grows at even lower levels than *R. implexum* or becomes free floating. Its filaments are straight; the rhizoids are rare and very simple.

Rhizoclonium lubricum Setchell & Gardner, *apud* Gardner, 1919:492. *pl. 42, fig. 5*; — Setchell & Gardner, 1920b:185. *pl. 9, fig. 5.*

In our range known only from Coos Bay.

Three Oregon collections are referred to this species since they are distinguishable from the rest by their long lubricous filaments, more delicate cell walls, and much less dense chloroplasts. One collection (*MD 2232*) was found attached to *Fucus* in upper Coos Bay and the other two (*MD 4922* and *4621*) were floating as large mats four to six feet in diameter in lower Coos Bay. The collection *4621* has thick-walled cells and filaments that are up to 90 μ in diameter. However, it is in other respects quite like the other two collections referred to this species. (See the note under *R. riparium* for a comparison of the species.)

Rhizoclonium implexum (Dillwyn) Kützing, 1845:206; — Setchell & Gardner 1920b:183; — Smith, 1944:62. *pl. 8, fig. 3.*

The cell walls in the one collection from Sunset Bay are often separated from each other, so that the cells resemble boxes with convex ends enclosed within a sheath. (See note under *R. riparium* for a comparison with other species.)

UROSPORA Areschoug, 1866

Urospora doliifera (Setchell & Gardner) comb. nov.

Hormiscia doliifera Setchell & Gardner, 1920a:297; — Setchell & Gardner 1920b: 193.

PLATE 7, FIGS. 3, 5, 8

Cells frequently with a breadth 3–4 times the length; the filaments decidedly clavate, often from (25)–40–60 μ in diameter at the base and up to 200 or 250 μ in the upper regions, and quite variable in diameter as Kylin (1907:18) describes for *U. incrassata*; fertile cells often spherical and 135 μ in diameter or larger; walls of largest cells 7–9 μ thick.

Along the north shore of Chetco Cove in June forming a green coating at HHLW on smooth boulders almost buried in the sand.

Urospora doliifera is of much greater diameter than *U. Hartzii* Rosenvinge, which also has different cells and more clavate filaments. Similarly or in individual respects it differs from *U. crassa* and *U. incrassata.*

Urospora grandis Kylin, 1907:18. *text fig. 3.*

Hormiscia grandis (Kylin) Setchell & Gardner, 1920b:195. *pl. 9, fig. 3.*

PLATE 7, FIGS. 1–2

Between HHLW and MLLW forming patches on rocks and on mussels from the south jetty of Coos Bay to Harris State Park.

Oregon material agrees with Kylin's description and illustration, except that the largest cells of the filaments are 70 μ in diameter. The cell walls in this material are about 14 μ in thickness. The filaments below are

about 25 μ in diameter. This species differs most conspicuously from *U. collabens* in that that species is up to 450 μ in diameter.

Urospora penicilliformis (Roth) Areschoug, 1866:16; — Smith, 1944:64. *pl. 6, figs. 2–3.*
Hormiscia penicilliformis (Roth) Fries, 1835:327; — Setchell & Gardner, 1920b: 191. *pl. 9, fig. 4.*

PLATE 7, FIG. 4

Above HHLW throughout the range on rocks and woodwork, often growing intermingled with *Bangia vermicularis*.

Differing from other Oregon species in having, in addition to extramatrical rhizoids, cells with relatively thin walls and filaments that are rather uniform in diameter throughout their length. Material collected at Otter Point (*MD 6181a*, and *MD 6224*) has filaments up to 100 μ in diameter, with spherical fertile cells.

Urospora Wormskioldii (Mertens) Rosenvinge, 1893:920. *fig. 36.*
Hormiscia Wormskioldii (Mertens) Fries, 1835:328; — Setchell & Gardner, 1920b: 196.

PLATE 7, FIG. 9

Found once (*MD 2006*, June) at Coos Head in a high tidepool. The individual filaments were growing free from each other.

Filaments usually up to 6 cm. tall but some individuals up to 20 cm. and gradually tapered to the base which is attached by intramatrical rhizoids from the last 15–30 cells. In young filaments, the cells are cylindrical throughout. In old filaments, cell divisions in the lower portions give rise to short doliiform cells shorter than their diameter; cells in the apical region swell until spherical, and are up to 850 μ in diameter. The youngest filaments seen, in which the cells were about as long as broad and cylindrical in outline, were 33 μ in diameter and evenly of this diameter throughout. Chloroplasts in both the youngest and oldest filaments are loosely reticulate.

ZYGNEMATALES
ZYGNEMATACEAE

ZYGNEMA C. Agardh, 1824

On stones in the mouth of a creek one-quarter mile south of Harris State Park there is a sterile fresh water species of *Zygnema* in an area reached by the highest spring tides.

CHLOROCOCCALES
ENDOSPHAERACEAE

CHLOROCHYTRIUM Cohn, 1872

Chlorochytrium inclusum Kjellman, 1883:320. *pl. 31, figs. 8–17*; — Smith, 1944: 67. *pl. 8, fig. 2.*

Cells of this species were found in abundance in several collections of *Dilsea californica* (*e.g.*, *MD 6102f*, washed in south of the Chetco River,

July) where they were embedded in the cortex and subcortex. The cells were up to 180 μ broad and usually about 120 μ tall. While the portion of the cell wall towards the thallus surface was thickened, there was no mammillate protuberance to be observed. Since only herbarium material was available for examination this lack of a protuberance might be due to the method of treatment, or this might be a distinct form.

Chlorochytrium porphyrae Setchell & Gardner, *in* Gardner, 1917:379. *pl. 32, fig. 6*; — Setchell & Gardner, 1920b:150. *pl. 15, fig. 1*; — Smith, 1944:67. *pl. 8, fig. 1.*

In *Porphyra lanceolata* and *P. perforata*, and also on *Erythrotrichia* sp. growing on *Ulva vexata*, at Chetco Cove. This is the only record of the occurrence of this species between Cape Flattery, Washington, and San Francisco. Present in abundance at this station.

SIPHONALES

HALICYSTIDACEAE

HALICYSTIS Areschoug, 1850

Halicystis ovalis (Lyngbye) Areschoug, 1850:447; — Setchell & Gardner, 1920b:155. *pl. 14, fig. 3*; — Smith, 1944:70. *pl. 9, fig. 1.*

At all stations from Cape Arago south.

The thalli are generally smaller (average diameter of mature thalli 5 mm.) than those to be found along the coast of central California. This species usually grows on vertical shaded surfaces exposed to well-aerated water.

DERBESIACEAE

DERBESIA Solier, 1847

Derbesia marina (Lyngbye) Kjellman, 1883:316; — Setchell & Gardner, 1920b:165. *pl. 15, fig. 3*; — Smith, 1944:71. *pl. 8, fig. 4.*

Ultimate branches 40 μ in diameter, those at the base 60 μ; the sporangia immature, pyriform, 180 μ long by 100 μ broad, with the narrow end attached to a slender pedicel about 40 μ long and 10 μ in diameter; the pedicels curved upwards from the point of attachment and containing a plug about 10 μ long; branching sub-dichotomous; the branches even, not constricted at their bases.

Collected once (*MD 5286*) from about the base of *Nienburgia Andersoniana* at Middle Bay, on shaded vertical LLLW rocks, July.

BRYOPSIDACEAE

BRYOPSIS Lamouroux, 1809

Bryopsis corticulans Setchell, 1899, *in* Phyc. Bor.-Amer. fasc. 13:626; — Setchell & Gardner, 1920b:160; — Smith, 1944:73. *pl. 9, fig. 3.*

Common to most stations along the Oregon coast. Found throughout the summer months just above the sand line on vertical rock surfaces that

are rather exposed to wave action. Usually between LHLW and MLLW levels; though rarely found as high as HHLW.

The specimens seen from Oregon are not as coarse as is typical of *B. corticulans* and usually have been referred to other species. Examination of the rhizoids and the arrangement of the branches shows no essential difference between such collections and the characteristic *B. corticulans* from California. In the later months of the summer and during the fall months this species is epiphytic on *Egregia* and occasionally on *Nereocystis* and *Rhodomela*. These epiphytic thalli are coarser and are more like the typical form. At the University of California there is only one collection north of central California and this is a typically coarse specimen from Puget Sound.

It might be added that in more protected habitats the branches are smaller in diameter and are predominantly distichous though becoming somewhat irregularly branched. Those which grow exposed to the surf, or on other algae, are of the coarse form typical of *B. corticulans*.

Superficially all the material of *Bryopsis*, except that collected in the most exposed situations on the Oregon coast, looks similar to West Coast specimens labeled Bryopsis hypnoides Lamouroux (1809: pl. 1, figs. 2a–2b) in both the herbaria of the University of California and of Stanford University. In the author's opinion West Coast specimens identified as *B. hypnoides* are probably growth forms of *B. corticulans*; at least they are not the same as East Coast *B. hypnoides*.

VAUCHERIACEAE

VAUCHERIA De Candolle, 1803

Vaucheria Thuretii Woronin, 1869:157. *pl. 12, figs. 30–32*; — Farlow, 1881:104. *pl 4, fig. 2*; — Nordstedt, 1886:3; — Taylor, 1937:100.

Known only from a few collections made at Charleston, Oregon, on South Slough. Here this alga forms dull blackish-green mats about 2 inches thick and often a few feet in diameter among *Salicornia* plants. In places it is covered by salt water with each of the highest of the high tides. It has also been collected on the mud flats about Humboldt Bay, Humboldt County, California (*MD 6231*). At this latter station the alga did not form such thick mats and the filaments seemed to be more or less prostrate. *Vaucheria Thuretii* has not been previously recorded from the Pacific Coast of North America.

The filaments of the Oregon collections are partially erect, forming mats about 2 inches thick, the lower part (1.5 inches) of which is dead and clogged with mud; the living and dead portions are separated by septa. Branches of two sorts: (1) stout more or less erect branches, and (2) small slender branches formed posterior to the growing part of the filament and extending laterally, binding the more erect branches together. Erect branches 80 to 100 μ in diameter; lateral branches 30 μ or less.

Vaucheria Thuretii is homothallic with the antheridia and oogonia borne in succession toward the apex of erect branches. A branch usually bears

a single oogonium and several antheridia, the most mature of which is nearest the oogonium. The antheridia are seated on a small swelling along the main branches and are developed in acropetal succession from the oogonia towards the apex. They are ovate or somewhat broadly pyriform with one apical pore and are mostly 70 μ tall and 45 μ broad at maturity. At first the oogonia are erect and broadly elliptical; as they increase in size, growth is unilateral so that the tip comes to be directed towards the nearest antheridium, at about right angles to the original axis. After fertilization the oogonium becomes more ovoid and eventually over 200 μ in its largest diameter. Mature zygotes in Oregon specimens are spherical, smooth, brownish-black, and up to 180 or 200 μ in diameter.

The oft-repeated statement that the zygotes are elliptical or ovate apparently rests upon Nordstedt's (1886:3) statement, ". . . oospores 0,12–20 m.m. broad, by 0,17 to 24 m.m. long." Woronin's original description is devoid of a description of the zygote. The type material contained no mature zygotes and the only indication of their size and shape insofar as that discussion is concerned is from the size given for the oogonia, ". . . gewöhnlich im Durchmesser 0,2 bis fast 0,3 Mm." and from the excellent colored plate which shows the antheridia and eggs or immature zygotes. The Oregon thalli have fewer antheridia but these are the same size and shape as those in Woronin's figure and description of the type.

CODIACEAE

CODIUM Stackhouse, 1797

Codium fragile (Suringar) Hariot, 1889:32; — Setchell & Gardner, 1920b:171. *pl. 28–29*; — Smith, 1944:75. *pl. 9, fig. 5.*

Throughout the range, usually forming hemispherical clumps near MLLW but the proper position in the vertical range is uncertain.

This species is often frayed as though it had been chewed by some gastropod. It is often covered by *Ceramium codicola*, but along the coast of Oregon it has not yielded the wealth of endophytic brown algae so frequently found in thalli of *C. fragile* growing along the coast of California.

Codium Setchellii Gardner, 1919: 489; — Setchell & Gardner, 1920b:168. *pl. 9, figs. 10–11, 30*; — Smith, 1944:75. *pl. 9, fig. 4.*

Found throughout the range on shaded vertical rock surfaces, such as the walls of narrow crevices. The felt-like masses of this alga are often many square decimeters in area. Usually growing between LHLW and approximately halfway between LHLW and HHLW and with the vertical distribution controlled more by exposure to sunlight than by tidal level.

PHAEOPHYTA

ISOGENERATAE

ECTOCARPALES

ECTOCARPACEAE

ECTOCARPUS Lyngbye, 1819

Ectocarpus granulosus (J. E. Smith) C. Agardh, 1828:45; — Setchell & Gardner, 1925:426; — Smith, 1944:81. *pl. 11, figs. 1–2.*

Common on the larger brown algae, buoys, rocks, and woodwork along Cape Arago and within Coos Bay.

The cortication and the opposite branchings are clearly evident in entire plants. These are often not evident in fragmentary material. In such cases the characters of most use are: (1) the size and proportionate shape of the sporangia, and (2) the major branches not being reduced in size at their bases. The largest of the Oregon specimens assume the ropy symplocoid habit of *Pterosiphonia robusta* or *Spongomorpha coalita*, and have for this reason often been identified on this coast as *E. tomentosus*.

Ectocarpus siliculosus (Dillwyn) Lyngbye, 1819:131 (in part). *pl. 43, fig. C*; — Setchell & Gardner, 1925:410.

Thalli up to 3 cm. tall, epiphytic at first but often becoming free-floating; branching alternate, older branching appearing dichotomous, with the main axes up to 60 μ in diameter, uncorticated; cells cylindrical, as short as 0.6 but more frequently of cells 1.0 to 1.5 times as long as broad; ultimate branches about 20 μ in diameter at their bases, lax and long-attenuate, of cylindrical cells up to 1.5 times as long as broad, or the cells may be slightly constricted at their cross walls; plurilocular organs developing from these ultimate branches and for the most part one cell broad, 15 to 25 μ wide and 250 μ or more long, the tip often remaining sterile or becoming hair-like.

Floating in Coos Bay (*MD 2469*) in July.

?Ectocarpus confervoides (Roth) LeJolis, 1863:75.

Gardner in his notebooks under the number *2744* lists the variety (forma) *typicus* from North Bend. This is probably the basis of Setchell & Gardner's (1925:414) report of this variety from Oregon.

Ectocarpus variabilis (Saunders) G. M. Smith, 1942:647. *figs. 1–4*; — Smith, 1944:85. *pl. 10, figs. 2–4.*

In Gardner's notes under number *2692* there is a recording of this species from *Nereocystis*, "from Lighthouse, Cape Arago."

Ectocarpus acutus Setchell & Gardner, 1922e:404. *pl. 48, figs. 36–39*; Setchell & Gardner, 1925:415; Smith, 1944:80. *pl. 10, fig. 1.*

On kelps and *Zostera* in lower Coos Bay.

Ectocarpus acutus var. **haplogloiae** var. nov.

Ectocarpus acutus Setchell & Gardner, 1922e:404 (in part).

PLATE 8, FIG. A

Frondes usque ad 3 cm. altitudine; axes maiores infra corticati, 60 μ diametro, cellulae hic magna ex parte $\frac{1}{2}$ breviores quam latae vel minus; ramificatio infra alternata aut irregularis, supra unilateralis facta; rami ultimi 7–10 μ diametro, e cellulis subdoliiformibus, 1.2 plo longioribus quam latis, ad apices acutos gradatim attenuatis compositi; chromatophori ligulati; sporangia plurilocularia in pediculo ex una paucisve cellulis constante, 19–35 x 100–200 μ, elliptico-lanceolata.

Fronds up to 3 cm. tall; major axes below corticated, 60 μ in diameter, cells here mostly half as long as broad or less; branching alternate or irregular below, becoming secund above; ultimate branches 7–10 μ in diameter, composed of slightly doliiform cells 1.2 times as long as broad, gradually tapered to acute apices; chromatophores bandshaped; plurilocular sporangia on one or few-celled pedicels, 19–25 x 100–200 μ, elliptical-lanceolate.

On *Haplogloia Andersonii* from Neah Bay, Washington (*Gardner 3817*), Middle Bay (**type:** *MD 2491*, July 30, 1940), Brookings (*O'Neal 378b*), and Moss Beach, San Mateo County, California (*MD 6056*, in June).

While this entity differs little from the species above in microscopic dimensions, these differences are rather constant and the habitat is distinctive.

Ectocarpus pygmaeus Areschoug *apud* Kjellman, 1872:85.

Ectocarpus confervoides var. *pygmaeus* Saunders, 1898:154. *pl. 15, figs. 5–9*; — Setchell & Gardner, 1925:415; — Smith, 1944:84.

On stipes of *Laminaria Sinclairii* (*MD 2401*, Squaw Island), *Pterygophora* (*MD 1894*, North Bay), and *Nereocystis* (*MD 2339*, North Bay), all in July.

Ectocarpus terminalis Kützing, 1845:236; — Setchell & Gardner, 1925:421.

Forming small tufts or velvety circlets that enlarge and fuse into areas of indefinite extent and shape, on the stipes and blades of various kelps throughout the range.

PYLAIELLA Bory, 1823

Pylaiella littoralis (L.) Kjellman, 1872:99; — Setchell & Gardner, 1925:402. *pl. 37, fig. 32.*

One collection (*MD 4229*, September) from woodwork in Siuslaw Bay below Glenada. Gardner under the number *2746*, in his notebooks, records this species from *Fucus* at North Bend.

Pylaiella unilateralis Setchell & Gardner, 1922d:386. *pl. 42, figs. 6–8*; — Setchell & Gardner, 1925:404.

Known only from the type (*Gardner 2748*) collected on rocks near the high tide line, "Sunset Beach, near the mouth of Coos Bay, Oregon," which location probably is Sunset Bay.

RALFSIACEAE

RALFSIA Berkeley, 1843

Ralfsia fungiformis (Gunnerus) Setchell & Gardner, 1924:11; — Setchell & Gardner, 1925:499.

Dr. G. J. Hollenberg has determined this in a collection (*MD 2130*) from Middle Bay.

Ralfsia pacifica Hollenberg, *in* Smith, 1944:95. *pl. 12, figs. 4–6* (*nom. nud.*)

Ralfsia verrucosa Setchell & Gardner, 1925:497 *non* (Areschoug) J. Agardh 1848:62.

A sterile collection from Cape Arago was determined as this species by Dr. Hollenberg. The range given for this species (*i.e., R. verrucosa*) by Setchell & Gardner is "Bay of Unalaska, Alaska, to Monterey Bay, California." This is an illegitimate name for this alga.

ELACHISTEACEAE

ELACHISTEA Duby, 1830

Elachistea fucicola (Velley) Areschoug, 1842:235. *pl. 8, figs. 6–7*; — Setchell & Gardner, 1925:503. *pl. 38, figs. 33–35.*

Known only from the record published by Setchell & Gardner, and by one collection (*MD 2233*) on *Fucus evanescens* at the mouth of Haynes Slough in Coos Bay.

HETEROCHORDARIACEAE

HETEROCHORDARIA Setchell & Gardner, 1924

Heterochordaria ɛbietina (Ruprecht) Setchell & Gardner, 1924:6; — Setchell & Gardner, 1925:550. *pl. 36, figs. 18–19*; *pl. 91*; — Smith, 1944:98. *pl. 14, fig. 3.*

Common throughout the range in the upper part of the LHLW to HHLW zone.

SPHACELARIALES

SPHACELARIACEAE

SPHACELARIA Lyngbye, 1819

Sphacelaria racemosa Greville, 1824. *pl. 96*; — Setchell & Gardner, 1925:393.

Present as sand-choked tufts in LHLW level shallow tidepools and on rocks at similar levels (*MD 2782*, Lighthouse Beach, December; *MD 4216*, December, and *MD 4713*, July, both from Brookings). Known south of Puget Sound only by these three collections.

DICTYOTALES

DICTYOTACEAE

DICTYOTA Lamouroux, 1809

Dictyota flabellata (Collins) Setchell & Gardner, 1924:12; — Setchell & Gardner, 1925:652. *pl. 34, fig. 3; pl. 35, fig. 7; pl. 36, figs. 13–17*; — Smith, 1944:101. *pl. 15, fig. 6.*

Known from two collections of specimens washed in at North Bay (*MD 5056* and *4977*, both late July).

The specimens are up to 30 cm. tall and in form like Gardner's plant (*4957*) from Ensenada, Baja California, but their color is more like his collection (*6595*) from Carmel Bay, California. Young specimens of this species are yellowish or brownish and more or less evenly colored throughout. With age and increased size the base becomes darker brown and this contrasts sharply with the more yellowish tips. There seems to be no difference between the Oregon specimens and many specimens from this coast identified as *D. Binghamiae* J. Agardh. The North Bay material seemed healthy in every respect, indicating that it was from the local area.

HETEROGENERATAE

CHORDARIALES

CHORDARIACEAE

HAPLOGLOIA Levring, 1939

Haplogloia Andersonii (Farlow) Levring, 1939:50; — Setchell & Gardner, 1925:556. *pl. 47, figs. 8–10; pl. 48, figs. 12–14; pl. 49, fig. 17; pl. 76*; — Smith, 1944:117. *pl. 16, figs. 1–2.*

Common throughout the range, usually around the margins of tidepools at levels above MLLW.

MYRIONEMATACEAE

MYRIONEMA Greville, 1827

Myrionema primarium Setchell & Gardner, 1922a:334. *pl. 34, fig. 12*; — Setchell & Gardner, 1925:456. *pl. 55, fig. 12*; — Smith, 1944:105.

Myrionema foecundum fa. *majus* Setchell & Gardner, 1922a:338. *pl. 32, fig. 7.*

The type locality is on the "outer end of the young blade of *Costaria costata*, mouth of Coos Bay, May"; presumably this is Sunset Bay. Also on other Laminariales along Cape Arago.

CORYNOPHLAEACEAE

LEATHESIA Gray, 1821

Leathesia difformis (L.) Areschoug, 1847:376; — Setchell & Gardner, 1925:511. *pl. 40, fig. 52; pl. 43, figs. 65–66*; — Smith, 1944:144. *pl. 15, fig. 2.*

Common throughout the range between LHLW and MLLW.

Leathesia nana Setchell & Gardner, 1924:3; — Setchell & Gardner, 1925:511. *pl. 43, fig. 67*; — Smith, 1944:115. *pl. 15, fig. 1.*

The two Oregon collections are much smaller than usual. As is typical for this species they were epiphytic on *Phyllospadix* (*MD 2332*, North Bay; *MD 6127*, north shore of Chetco Cove).

DESMARESTIALES

DESMARESTIACEAE

DESMARESTIA Lamouroux, 1813

Desmarestia latifrons (Ruprecht) Kützing, 1859:40. *pl. 95*; — Setchell & Gardner, 1925:563. *pl. 90*; — Smith, 1944:120. *pl. 18, fig. 1.*

This alga is common at two stations, Harris State Park and Sunset Bay, below the MLLW level.

The author has found no material collected in Coos Bay. Setchell & Gardner list Coos Bay as the northern limit for the species. Their statement is based on a collection by Gardner (*2669*) labeled, "Sunset Beach, Mouth of Coos Bay" but, as shown in the list of stations from which material has been collected, the locality named by Gardner lies several miles south of Coos Bay and unlike that station is a location with very little variation in salinity.

Desmarestia intermedia Postels & Ruprecht, 1840:13. *pl. 26*; — Setchell & Gardner, 1925:564.

One collection (*J. C. Queen 82*) washed ashore at Sunset Bay.

Differing from *D. latifrons* in having much narrower and more nearly terete branches. Except for some of the ultimate tips there are no aculeate spiny branches as in *D. aculeata.*

Desmarestia herbacea (Turner) Lamouroux, 1813:25; — Setchell & Gardner, 1925: 566. *pl. 88*; — Smith, 1944:121. *pl. 17, fig. 2.*

Throughout the range in well-aerated water below the LLLW level but nowhere present in quantity.

This species differs from the broader species in having several orders of branches each successively reduced in size. Unlike other broad species, the midrib of *D. herbacea* gives rise to simple veinlets that curve gently upward to the oppositely placed bladelets with only a few, if any, prominent aculeae present.

Desmarestia munda Setchell & Gardner, 1924:7; — Setchell & Gardner, 1925:567. *pl. 89*; — Smith, 1944:121. *pl. 17, fig. 1.*

Throughout the range on floating woodwork and on channel bottoms in well-aerated situations.

Most of the Oregon collections that belong to the section *Herbaceae* can be placed here. *Desmarestia munda* differs from *D. herbacea* in having a broader main axis often with the lateral veins from the midrib having

a geniculate upward curve, from the abaxial side of which a branch vein may descend. In addition, and perhaps most significantly, this species has the branches of the second order or their lateral blades much broader or more foliose (and often curved and oblanceolate) than the main axis and its lateral bladelets. *Desmarestia munda* is to be distinguished from *D. latissima* by having more orders of branches and narrower, thicker, more darkly colored fronds. In Coos Bay on the mud flats and in quiet water the thalli of *D. munda* are broader in form, thinner and lighter in color (*e.g.*, *MD 2258* and *2132*, old jetty in Coos Bay, in July) and have usually been referred to as *D. latissima*.

PUNCTARIALES

ENCOELIACEAE

ILEA Fries, 1835

Ilea fascia (Müller) Fries, 1835:321; — Smith, 1944:126. *pl. 20, fig. 4.*

Epiphytic and saxicolous (MLLW to LHLW), common throughout the range.

SORANTHERA Postels & Ruprecht, 1840

Soranthera ulvoidea Postels & Ruprecht, 1840:19; — Setchell & Gardner, 1925: 525. *pl. 39, figs. 40, 41*; *pl. 83, fig. b*; — Smith, 1944:127. *pl. 20, fig. 5.*

On *Odonthalia* and *Rhodomela* throughout the range.

COLPOMENIA Derbès & Solier, 1856

Colpomenia sinuosa (Roth) Derbès & Solier, 1856:11. *pl. 22, figs. 19–20*; —Setchell & Gardner, 1925:539. *pl. 45, figs. 82–86*; — Smith, 1944:128. *pl. 20, fig. 1.*

Common throughout the range and, insofar as observed, an epiphyte on other algae between LHLW and MLLW.

Oregon forms seem to be elements of a homogeneous developmental sequence and, therefore, their segregation into varieties has not seemed justifiable.

SCYTOSIPHON C. Agardh, 1811

The generic and specific interrelationships within the Encoeliaceae, probably a polyphyletic and unnatural aggregation, are in great need of critical study. A morphological and cytological life history study would be of great value. Particularly there has been confusion as to which genus the *Scytosiphon bullosus* of Saunders, the *Coilodesme bulligera* of Strömfelt, and the *Myelophycus intestinalis* of Setchell & Gardner belong, and as to the significance of shape, twisting and constriction in the remainder of the species of these genera. In order to make this author's current views more clear on some of these species, the following key is presented.

1. Slender, linear, sometimes complanate thalli, saxicolous in habit (*Scytosiphon*) 4
1. Finger-like or broadly inflated, epiphytic or saxicolous..... 2

2. With a broad, often irregularly lobed base, saxicolous .....
Scytosiphon bullosus Saunders

2. With a slender stipe that may be very short or sometimes nearly filamentous and conspicuous, mostly epiphytic 3

3. Saxicolous, stipe slender, elongate .....
Coilodesme bulligera Strömfelt

3. Epiphytic, stipe slender, very short .....
Coilodesme californica (Rupr.) Kjellm.

4. Fronds flattened, not constricted .....
Scytosiphon complanatus (Rosenvinge)

4. Fronds cylindrical, usually hollow, often constricted 5

5. Fronds over 1 mm. in diameter, usually constricted .....
Scytosiphon lomentaria (Lyngb.) J. Agardh

5. Fronds less than 1 mm. in diameter, not constricted .....
Scytosiphon attenuatus (Foslie)

Scytosiphon bullosus Saunders, 1898:163. *pl. 31, figs. 1–7*; — Smith, 1944:130.
Colpomenia sinuosa fa. *deformans* Setchell & Gardner, 1925:542.

Locally common on horizontal LHLW to MLLW rocks at South Bay (*C. L. Doty 1976*), Sunset Bay (*MD 2622*), and Brookings (*MD 2598*).

Scytosiphon lomentaria (Lyngbye) J. Agardh, 1848: 126; — Setchell & Gardner, 1925:531; — Smith, 1944:129. *pl. 19, fig. 1.*

This is the fa. *typicus* of Setchell & Gardner and is for the most part a form found in tidepools at high levels and is common throughout the range.

Two other entities occurring in our range are accorded the rank of forms by Setchell & Gardner. Since these, in addition to being quite distinct morphologically, are distinct in mode of growth habit and in habitat, they are treated below as separate species. They cannot be considered ecological variations because they occasionally occur out of their usual ecological niche.

Scytosiphon complanatus (Rosenvinge) comb. nov.
Scytosiphon lomentaria var. *complanatus* (Rosenvinge), 1893:863 (*fide* Smith); — Smith, 1944:130, in part.
Scytosiphon lomentaria fa. *complanatus major* Setchell & Gardner, 1925: 534.

PLATE 9, FIG. B

Frondes complanatae, non constrictae, usque ad 30 cm. longitudine atque 4 mm. latitudine, interdum tortae, ad basim apicemque attenuatae.

Fronds flattened, not constricted; up to 30 cm. long and 4 mm. broad; sometimes the fronds twisted and tapered toward both ends.

This species is found almost exclusively around the margins of tidepools or on floating timbers. Known from the following stations in Oregon: Seal Rocks (*A. R. Sweetser* collection in the University of California herbarium); Charleston wharves (*O'Neal 333b*, July); South Jetty of Coos Bay (*MD 1830b*, July); Squaw Island (*O'Neal 326b*, July); elsewhere in the Coos Bay and Cape Arago regions and Cape Blanco (*e.g., O'Neal 422a*, June [Dudley Herbarium *306924*]).

Scytosiphon attenuatus (Foslie) comb. nov.

Chordaria attenuata Foslie, 1887: 176, *pl. 3, fig. 3*; — Tilden, Amer. Algae 347.

Myelophycus intestinalis fa. *tenuis* Setchell & Gardner *in* Gardner, 1917: 385 (at least in part); — Collins, Holden & Setchell, Phyc. Bor.-Amer. 1919, fasc. 46:2295.

Scytosiphon lomentaria fa. *cylindricus major* Setchell & Gardner, 1925:533.

Scytosiphon lomentaria var. *complanatus* Smith, 1944: 130 (in part).

Scytosiphon lomentaria Collins, Holden & Setchell, Phyc. Bor.-Amer. 1905, fasc. 25:1235; 1907, fasc. 28: 1389; 1919, fasc. 46:2295.

PLATE 9, FIG. A

Frondes cylindricae, non constrictae, usque ad 12 mm. altitudine atque 1 mm. diametro; frons tota interdum spiraliter contorta, ad basim apicemque attenuata; frons iunior virido-brunnea, deinde, dum sporangia unilocularia maturescunt, rubido-brunnea facta; paraphyses multicellulares extra sporangia triente ad dimidium earum longitudinis excedentes.

Fronds cylindrical, not constricted, up to 12 cm. tall and 1 mm. in diameter, sometimes the whole frond spirally twisted, tapered at both ends; becoming redder brown from the young greenish brown color as the unilocular sporangia mature, enlarge (up to 47 μ tall), and become more conspicuous and thickly placed; multicellular paraphyses exceeding the sporangia by $\frac{1}{3}$–$\frac{1}{2}$ their length.

Growing in more or less extensive stands between LHLW and HHLW on sloping rocks. One collection (*MD 2544* [Dudley Herbarium 306923], Coos Head, late November) formed a more or less pure stand about 2 yards broad and perhaps 10 yards long. This species characteristically grows in extensive stands rather than in isolated tufts or in tidepools. The Gardner collection *4749* from, "Cape Arago, Mouth of Coos Bay," is the same entity as is another of Gardner's collections (his *4406*) from Fort Point, San Francisco, California; though this latter is a much finer form. In Oregon other collections have been made at Cape Blanco in June and at Middle Bay (*MD 2490*) in July.

It is suspected that *Myelophycus* on the west coast of the United States is merely a twisted form of *Scytosiphon*. The type of *Myelophycus intestinalis* fa. *tenuis* (*Gardner 2649*) and isotype (*in* Collins, Holden & Setchell — Phyc. Bor.-Amer. fasc. 46: 2295) are lower in stature but otherwise the same as this species in appearance.

COILODESME Strömfelt, 1886

Coilodesme bulligera Strömfelt, 1886:48. *pl. 2, figs. 9–12*; — Setchell & Gardner, 1925:581. *pl. 45, figs. 77–78.*

In Oregon known only from Gardner's collection *2742*, "on rocks, Coos Bay, . . . Sunset Beach. . . ." This appears to be the same as the specimens from Alaska and Japan available for study. The thallus which is plane, thinnish, and inflated at first, has a delicate almost threadlike stipe, a character immediately distinguishing this species from *Scytosiphon bullosus*. While Strömfelt's figures illustrate a similar alga, there is no thick-

ened axial portion in the material seen from the northeastern Pacific area as there is in his figures.

Coilodesme californica (Ruprecht) Kjellman, 1889:4–8. *figs. 1–8*; — Saunders, 1898:160. *pl. 29, figs. 1–3*; — Setchell & Gardner, 1925:579. *pl. 46, fig.* 1–2; *pl. 86*; — Smith, 1944:131. *pl. 19, fig. 5.*

Common, coextensive with the host, *Cystoseira osmundacea.*

The largest bullate Oregon specimens of *C. californica* look very much like the cotype of *C. amplissima* Setchell & Gardner in the University of California herbarium, but not like the type specimen of *C. amplissima* which is on a different host, and may very well represent a distinct species.

PHAEOSTROPHION Setchell & Gardner, 1924

Phaeostrophion irregulare Setchell & Gardner, 1924:10; Setchell & Gardner, 1925: 586. *pl. 38, fig. 36; pl. 50, fig. 8; pl. 85.*

Locally abundant around the margins of high tidepools southward from Seal Rocks; occasionally epiphytic at MLLW levels; present throughout the year.

While the holdfasts usually appear to be discoidal some young specimens (*MD 4011*) have rhizome-like proliferations from the margin of the disc as well as a very few rhizome-like protuberances from the portion of the stipe just above the basal disc. The blades originate as knobs on the basal disc. These elongate into digitiform prolongations that broaden into the young bladelets. The stipe does not elongate as the plant becomes older and the tips of the blades seem to erode without inhibiting the general growth of the alga. From this it is assumed that the region of cell division must be at the base of the blade.

LAMINARIALES

LAMINARIACEAE

LAMINARIA Lamouroux, 1813

Laminaria saccharina (L.) Lamouroux, 1813:22; — Setchell & Gardner, 1925:595.

Common on rocks and also on floating timbers, as far south as Coos Bay, and abundant there in the lower reaches of the bay.

Laminaria cuneifolia J. Agardh, 1867:10; — Saunders, 1901:429. *pl. 50, fig. 1*; — Setchell & Gardner, 1925:600. *pl. 59, figs. a–b*; *pl. 60.*

Collected in late June and July at North Bay and Cape Blanco in the MLLW to LHLW zone (*MD 2330, 2683* and *2615*, respectively). Previously this has not been recorded south of Puget Sound, Washington. In west coast herbaria there seems to be considerable confusion between forms of this species, *Laminaria saccharina* var. *linearis* (fa. *linearis* of Setchell & Gardner), and *Hedophyllum subsessile.*

Laminaria Sinclairii (Areschoug) Anderson, 1891:220; — Setchell & Gardner, 1925:598; — Smith, 1944:135. *pl. 31, fig. 1.*
Hafgygia Sinc'airii Areschoug, 1883:6.

Common throughout the range; on rocks nearly buried in sand between MLLW and LLLW. In December the regenerating forms such as those described by Setchell (1905:139 ff. *pls. 15–17*) are found in abundance.

Since there was no description published for the material assigned under the name "Sinclairii" by any previous author, Areschoug's description is the first legitimate publication of this specific name. Anderson then made the first legitimate combination as above.

Laminaria ephemera Setchell, 1901:121; — Setchell & Gardner, 1925:603. *pl. 58.*
Renfrewia parvula Griggs, 1906:251.

PLATE 10

Thalli annual; up to 135 cm. tall; holdfast discoidal at first but with finger-like lobes proliferating from the margins of the disc; stipes of mature thalli terete, 2 mm. in diameter, in the upper portion gradually merging with the blade; stipe 10–20 cm. long, without mucilage ducts; the epidermal layer consisting of one (rarely two) low columnar cells (20–27 μ tall); blade at first narrowly cuneate; 3–7 cm. broad in the widest portion; sporangia tending to be confined to a central large sorus.

Found in abundance on *Gracilaria* and on rocks at Sunset Bay (*MD 2757*, late August; *MD 2475*, late July; *C. L. Doty* and *O. R. O'Neal 1949*, early July; *MD 4589*, June 29).

The Oregon specimens have been compared with the type of *Laminaria ephemera* and with a co-type of *R. parvula* in the University of California herbarium. They are more like the latter than the former, but certainly this species.

Laminaria Andersonii Eaton *in* Hervey, 1881:98; — Setchell & Gardner, 1925:605; — Smith, 1944:137. *pl. 21, fig. 1.*

Common throughout the range and the best indicator of the top of the upper sublittoral zone, which is arbitrarily set as LLLW.

Unfortunately Hervey in describing this alga either had very young specimens or had old specimens with only one linear segment of the blade remaining. From his description of the blade one would be inclined to think that he was referring to *L. Sinclairii*, but the statements, "where it grows on rocks with *Pterygophora*" and ". . . with the usual branching holdfast," definitely indicate that *Laminaria Andersonii*, in the usual sense, is the alga to which he refers. Young thalli are often as narrow as described by Hervey.

The characteristic tearing of the mature blades of this species into linear segments is a result of the structure of the blade. Its structure is such that it tears much more readily in a direction parallel to the lateral margins than it does across the blade. Now and then a mature specimen with an entire blade may be found in a large tidepool — these forms have the

same "tearing" characteristics. It might be expected that if other large bladed Laminarias grew in the same exposed habitats as this species these too would be similarly torn.

PLEUROPHYCUS Setchell & Saunders *in* Saunders, 1901

Pleurophycus Gardneri Setchell & Saunders *apud* Saunders, 1901:427. *pl. 52.* Setchell & Gardner, 1925:607. *pl. 80, fig. a.*

Found as isolated individuals throughout the range in the upper sublittoral (*i.e.*, up to about 5 feet below LLLW), the southernmost collection (*MD 2579*) from Brookings in June and Cape Blanco (*O'Neal 377a*).

COSTARIA Greville, 1830

Costaria costata (Turner) Saunders, 1895:57; — Setchell & Gardner, 1925:610; — Smith, 1944:138. *pl. 22, fig. 1.*

Fucus costatus Turner, 1819: *pl. 226.*
Costaria Turneri Greville, 1830:39.
Laminaria costata C. Agardh, 1820:109; 1824:269.

Throughout the range in tidepools and below LLLW or higher in protected localities.

While Setchell & Gardner and other more recent authors have not recognized two species along this coast, Saunders did earlier and, in his 1895 paper cited above, he outlines clearly both the nomenclatorial situation and the characteristics of the two entities. With very few exceptions the specimens seen during the course of this investigation are clearly one or the other of these two entities.

The slender sometimes almost linear blade of this species is comparatively smooth and never cordate at the base. The stipe tends to be broadened and flattened above with rather conspicuous costae on the surface; likewise the rhizoids are delicate and almost entirely from the very base. This species is illustrated by Turner and by Smith, though the latter's illustration is of a rather unsually broad and bullate form. Turner's figure is a fine drawing of a blade less than 5 cm. broad by about 36 cm. long; the stipe shows the characteristic form and ribbing; there are no perforations in the blade. In the text he states that the figure was prepared from a drawing made by Menzies, since the actual specimen received was too much compressed to show the ribbing and bullation well.

Costaria Mertensii J. Agardh, 1848:140; — Setchell & Gardner, 1925: *pl. 56b*; — Smith, 1944:138.

Fucus costatus sensu Mertens, 1829:43–48, *non* Turner, 1819:72. *pl. 226.*
Costaria Turneri Postels & Ruprecht, 1840:12. *pl. 24* (*non* Greville).

In exposed situations throughout the range between LHLW and LLLW; possibly restricted to the lower portion of this vertical range.

This species is well illustrated by Postels & Ruprecht and also by Setchell & Gardner, though the specimen illustrated by the latter is rather narrow at the base. The broad bullate blade of this species is much more

cordate basally than in *C. costata,* and the short, more cylindrical stipe is less conspicuously costate and often has accessory rhizoids developed from above the first-formed stoutish rhizoids.

HEDOPHYLLUM Setchell, 1901

Hedophyllum sessile (C. Agardh) Setchell, 1899, *in* Collins, Holden & Setchell, Phyc. Bor.-Amer. fasc. A: 8; — Setchell & Gardner, 1925:617. *pl. 73.*

Throughout the range, this alga is one of the conspicuous forms indicating the MLLW to LHLW zone.

Hedophyllum subsessile (Areschoug) Setchell, 1901 *in* Collins, Holden & Setchell, Phyc. Bor.-Amer. fasc. B: 27; — Setchell & Gardner, 1903: 263. *pl. 20*; — Setchell & Gardner, 1925: 618.

Collections from Cape Arago (*MD 2196* and *2213*) made in June are certainly the same as certain of Setchell's collections in the University of California herbarium (his *5078* and *3286* from Uyak and Unalaska respectively) and labelled by him as, "Hedophyllum subsessile young!"

LESSONIACEAE

NEREOCYSTIS Postels & Ruprecht, 1840

Nereocystis luetkeana (Mertens) Postels & Ruprecht, 1840:9. *pls. 8–9*; — Setchell & Gardner, 1925:624; — Smith, 1944:141. *pl. 24.*

Common throughout the range off rocky promontories. In beds arising from slightly greater depths than *Macrocystis*, and therefore usually along the outer edges of stands of *Macrocystis*, if both are present at the same place. Anomalous dwarf forms are rather frequently found in large tidepools.

POSTELSIA Ruprecht, 1852

Postelsia palmaeformis Ruprecht, 1852:19 (75). *pls. 6–8* (not seen); — Setchell & Gardner, 1925:625. *pl. 69*; — Smith, 1944:142. *pl. 25.*

Locally abundant between LHLW and MLLW throughout the range; on rocks exposed to heavy surf.

MACROCYSTIS C. Agardh, 1823

Macrocystis integrifolia Bory, 1826:10; — Setchell & Gardner, 1925: 628. *pl. 62*; — Smith, 1944:143. *pl. 26.*

On boulder fields between MLLW and LLLW and sometimes somewhat lower, at several stations on Cape Arago.

Macrocystis pyrifera (L.) C. Agardh, 1820:47; — Setchell & Gardner, 1925:627. *pls. 64–65*; — Smith, 1944:144. *pl. 31, figs. 3–4.*

Growing in sublittoral beds off most rocky promontories throughout the range.

LESSONIOPSIS Reinke, 1903

Lessoniopsis littoralis (Tilden) Reinke, 1903:25–28. *fig. 8*; — Setchell & Gardner, 1925:632. *pls. 67–68*; — Smith, 1944:145. *pl. 27*.

Lessonia littoralis Tilden, 1900, Amer. Algae, 342.

Locally abundant throughout the range between MLLW and LLLW levels on the most wave-exposed solid rock surfaces.

Tilden in her American Algae gave the first diagnosis of this species though the name was a long used, variously accredited, *nomenum nudum* at the time.

ALARIACEAE

ALARIA Greville, 1830

Alaria marginata Postels & Ruprecht, 1840:11; — Setchell, 1908:98; — Yendo, 1919:93. *pl. 6, figs. 1–4; pl. 19, fig. 4*; — Setchell & Gardner, 1925:640. *pl. 66*; — Smith, 1944:147. *pl. 28*.

Common throughout the range in places exposed to either rapidly flowing water or turbulent water between MLLW and LHLW.

Appearing with *Postelsia* there is very often a short form with small crowded sporophylls. While this is possibly the *Alaria nana* of Schrader (1903:162) there seems to be no qualitative and no non-intergrading quantitative difference between that and the present species. Some collections (*e.g.*, *MD 2455*, docks at Charleston, in July) are the same form as has been separated under the name *Alaria praelonga* but this too seems but a variation of *A. marginata* when all collections are considered. These specimens, from various harbor environments, are thinner in all parts, are lighter in color when dried, and have broader blades and sporophylls than those collected along the shores of the open ocean. The material from these latter stations (*e.g.*, *MD 4057* from Brookings, in December) compares well with Setchell & Gardner's illustration, which they call, "a plant medium in all of its characters . . .", with the exception that ours has longer sporophylls.

The material formerly (Sanborn and Doty, *ined.*) assigned to *A. valida* is now considered to be merely a form of *A. marginata*. Gardner also at one time considered this form with broad sporophylls to be *A. valida*, for it is so recorded in his notebooks among notes concerning his Oregon collections.

PTERYGOPHORA Ruprecht, 1852

Pterygophora californica Ruprecht, 1852:17 (73). *pl. 5*; — Setchell & Gardner, 1925:634. *pl. 74*; — Smith, 1944:148. *pl. 29*.

Growing intermingled with *Laminaria Andersonii* from LLLW levels downward. It is very probable that it grows in extensive sublittoral beds as reported by Smith for the Monterey area. Common throughout the range.

Occasionally this alga appears in tidepools where at first sight the various forms are not recognizable as this species. Macmillan (1902) gives good illustrations showing the intergradations between young *Alaria*-like forms and these peculiar tidepool forms.

EGREGIA Areschoug, 1876

Egregia Menziesii (Turner) Areschoug, 1884:3; — Setchell & Gardner, 1925:467; — Smith, 1944:149. *pl. 30, fig. 1.*

Common throughout the range. This alga along with *Hedophyllum* and *Alaria* is one of the most dependable and readily identifiable indicators of the MLLW and LHLW zone.

CYCLOSPOREAE

FUCALES

FUCACEAE

FUCUS Linnaeus, 1753

Fucus furcatus C. Agardh, 1820:97; — Gardner, 1922:16. *pl. 1, fig. 1; pls. 2–17*; — Setchell & Gardner, 1925:664; — Smith, 1944:152. *pl. 32, fig. 2.*

Abundant along the entire coast of Oregon. Gardner (1922) names a number of varieties of this species and two of them, var. *elongatus* and var. *angustus*, are specifically reported from the central coast of Oregon. This species is an indicator of the lower part of the LHLW to HHLW zone.

Gardner (1922:16, etc.) emphasizes the presence or absence of two kinds of structures, which he calls caecostomata and cryptostomata, in distinguishing between species of *Fucus*. *Cryptostomata* are conceptacle-like cavities lined or filled with sterile hairs and possessing an ostiole; *caecostomata* are conceptacle-like cavities without an ostiole and are more or less empty. While Gardner discusses the detailed structure he gives no means of distinguishing between the two without making sections. When herbarium specimens are viewed by transmitted light, the caecostomata, actually empty spherules, appear as minute dark rings in the thallus. By reflected light they appear as small smooth lumps on the surface of the thallus. By transmitted light cryptostomata, actually spherules more or less solidly filled with hairs, appear as dark spots in the thallus. By reflected light they may appear as small smooth bumps with an ostiole (often obscure) and usually with a tuft of projecting hairs. Near the base of the thallus of *Fucus furcatus* the caecostomata are crowded and approximately 0.2 mm. in diameter; in the upper part of the thallus they are larger (up to 0.4 mm. in diameter) and more scattered.

Fucus evanescens C. Agardh, 1820:92–93; — Gardner, 1922:36. *pl. 1, fig. 2; pls. 35–59*; — Setchell & Gardner, 1925: 681. *pls. 106–107.*

On wharves and rocks (from HHLW to 1 foot higher) within bays and tidal river mouths; common throughout Oregon at least as far south as Coos Bay.

When one examines all of the branches in a large clump of *Fucus* the various branches seem to fall into two or three of the varieties described by Gardner (1922). For this reason it has been impossible to identify with certainty many of the varieties he has described for this species. However his variety *stellatus* is quite distinct and has been found (*MD 2261*) on the old jetty in Coos Bay.

Fucus edentatus var. **hesperius** Gardner, 1922:28. *pl. 21*; — Setchell & Gardner, 1925:678. *pl. 103.*

Known only from the type (*Gardner 2653*) from "Sunset Beach," Cape Arago.

PELVETIA Decaisne and Thuret, 1845

Setchell & Gardner (1925:701) give Coos Bay, Oregon as the northernmost limit of the range of *Pelvetia fastigiata* (J. Ag.) DeToni. Although especially sought for by the author, *P. fastigiata* has not been found in the Coos Bay area or elsewhere along the Oregon coast. Neither are there any specimens from Oregon in the University of California herbarium, and the northernmost specimens in that herbarium are from Bolinas Bay in central California. Thus it is thought that Setchell & Gardner's record of this species from Oregon is based upon (a misdetermination of?) *Pelvetiopsis limitata* (Setchell) Gardner.

PELVETIOPSIS Gardner, 1910

Pelvetiopsis limitata (Setchell) Gardner, 1913:321. *pls. 38–41*; — Setchell & Gardner, 1925:703. *pl. 46, fig. 6*; — Smith, 1944:155. *pl. 33, fig. 1.*

Common in the upper part of the HHLW to LHLW zone with the variety *typica* ("forma" *typica* of Gardner) throughout the range and the variety *lata* ("forma" *lata* of Gardner) present at Cape Blanco and as far north as North Bay.

SARGASSACEAE

CYSTOSEIRA C. Agardh, 1820

Cystoseira osmundacea (Menzies) C. Agardh, 1820:69; — Gardner, 1913:333 ff. *pls. 51–53*; — Setchell & Gardner, 1925:709; — Smith, 1944:156. *pl. 34.*

Collected throughout the range at least as far north as the Nehalem River; from MLLW down to LLLW and in places on down to the −10.0 foot level.

Oregon material may all be referred to the variety *typica* (forma *typica*) of Gardner.

(To be continued)

EXPLANATION OF PLATE 1

All figures are drawn with the aid of a camera lucida. The name and number in parentheses after the specific name identifies the material from which the drawing was made. The magnification is indicated at the end of each figure description.

Fig. 1–3. *Enteromorpha angusta* (*Gardner 4430*, **isotype**).

1. Edge of blade from upper portion of frond. × 244.
2. Center of blade in the apical region. × 244.
3. Cross section of upper portion of stipe margin. × 244.

Fig. 4–6. *Enteromorpha angusta* (*MD 6058*, **topotype**).

4. Cross section 0.5 cm. above base. × 260.
5. Surface view of cells. × 260.
6. Cross section of blade margin. × 260.

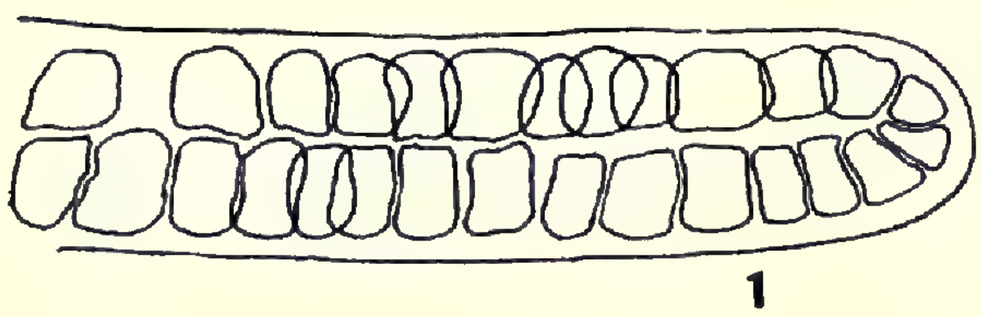
Fig. 7–9. *Enteromorpha linza*. Cross sections of center and margin of typical *E. linza* blades. × 282.

Fig. 10–11. *Enteromorpha linza* var. *oblanceolata* (*O'Neal 433*, **type**).

10. Center of upper part of blade. × 285.
11. Stipe margin. × 285.

Fig. 12–14. *Enteromorpha vexata* (*W. Wells 38*).

12–13. Cells in surface view; cross section through margin. × 250.
14. Cross section of stipe. × 67.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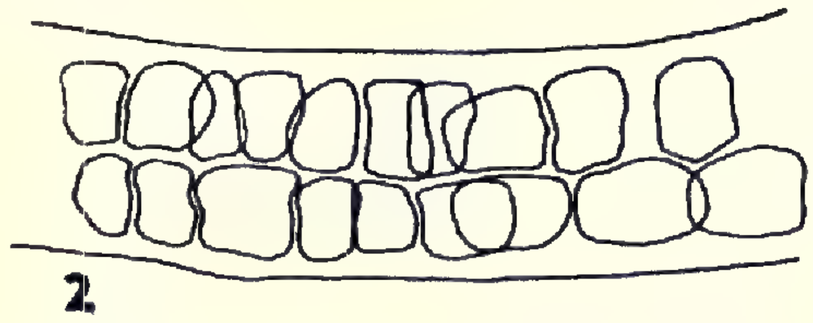
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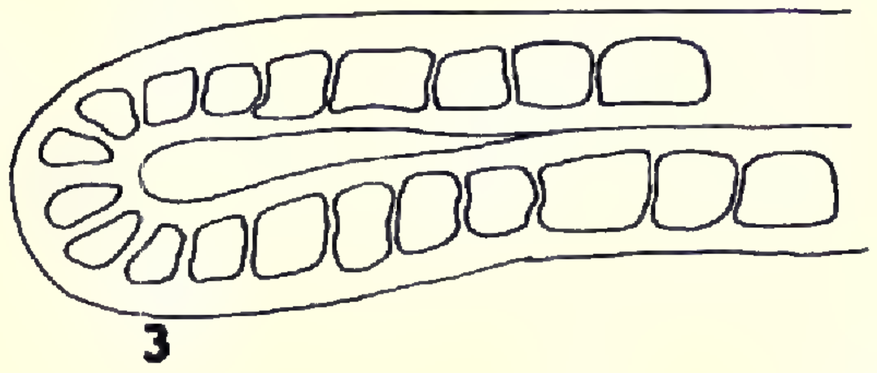
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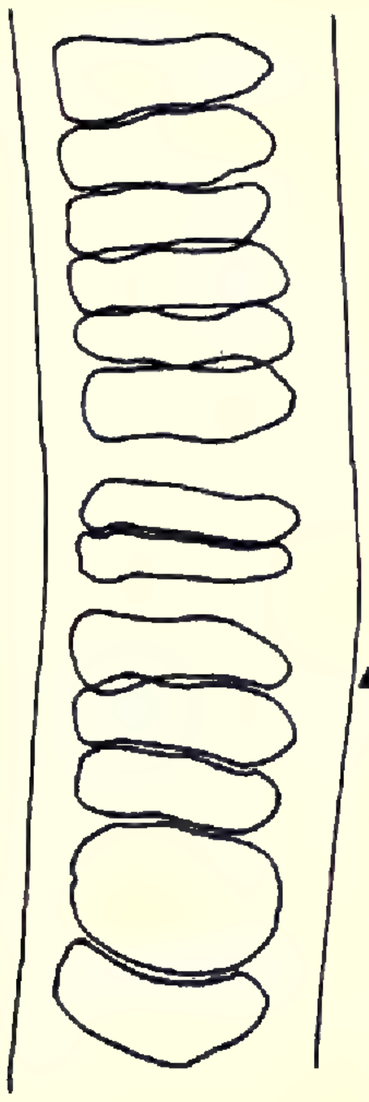
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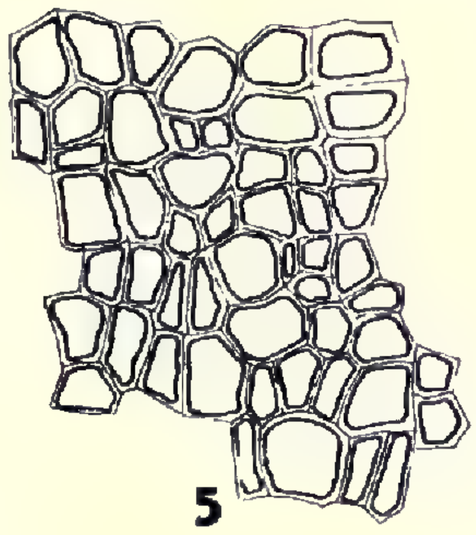
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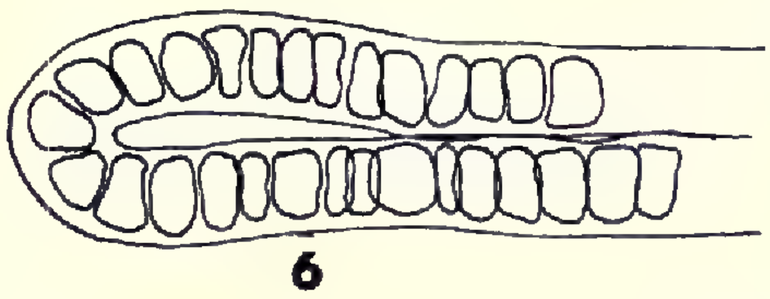
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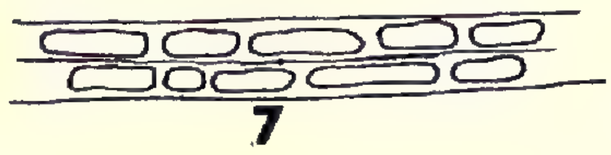
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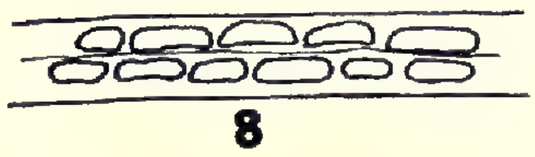
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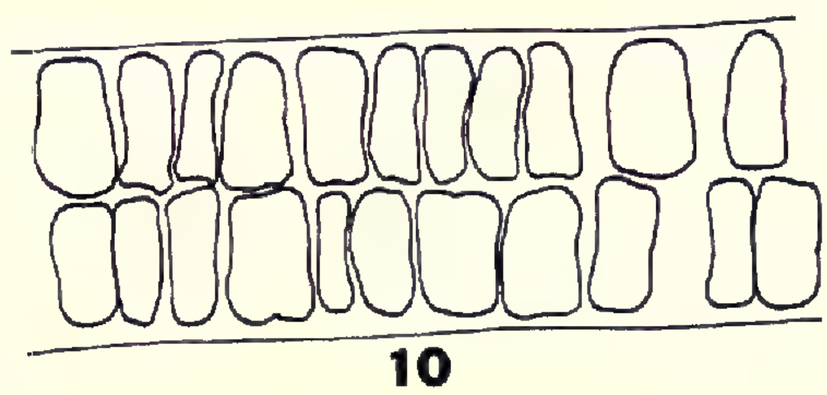
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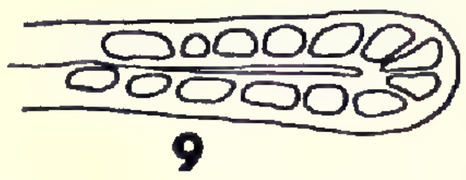
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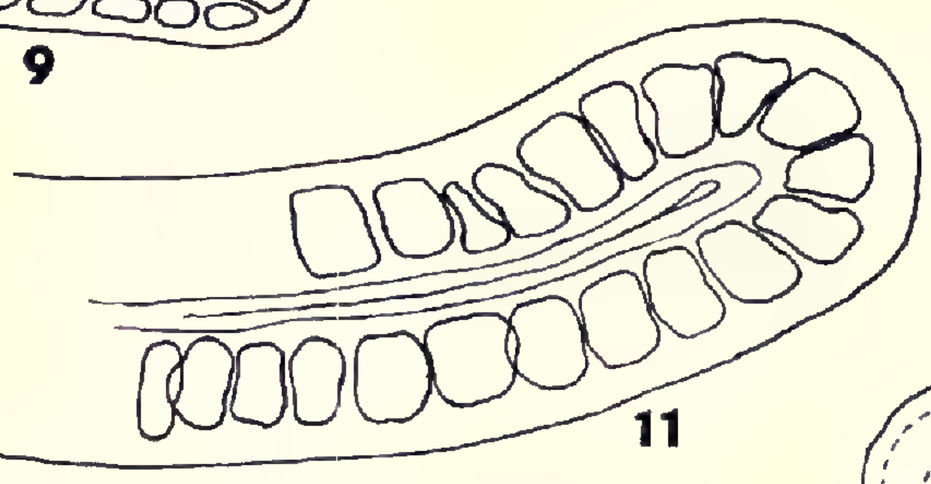
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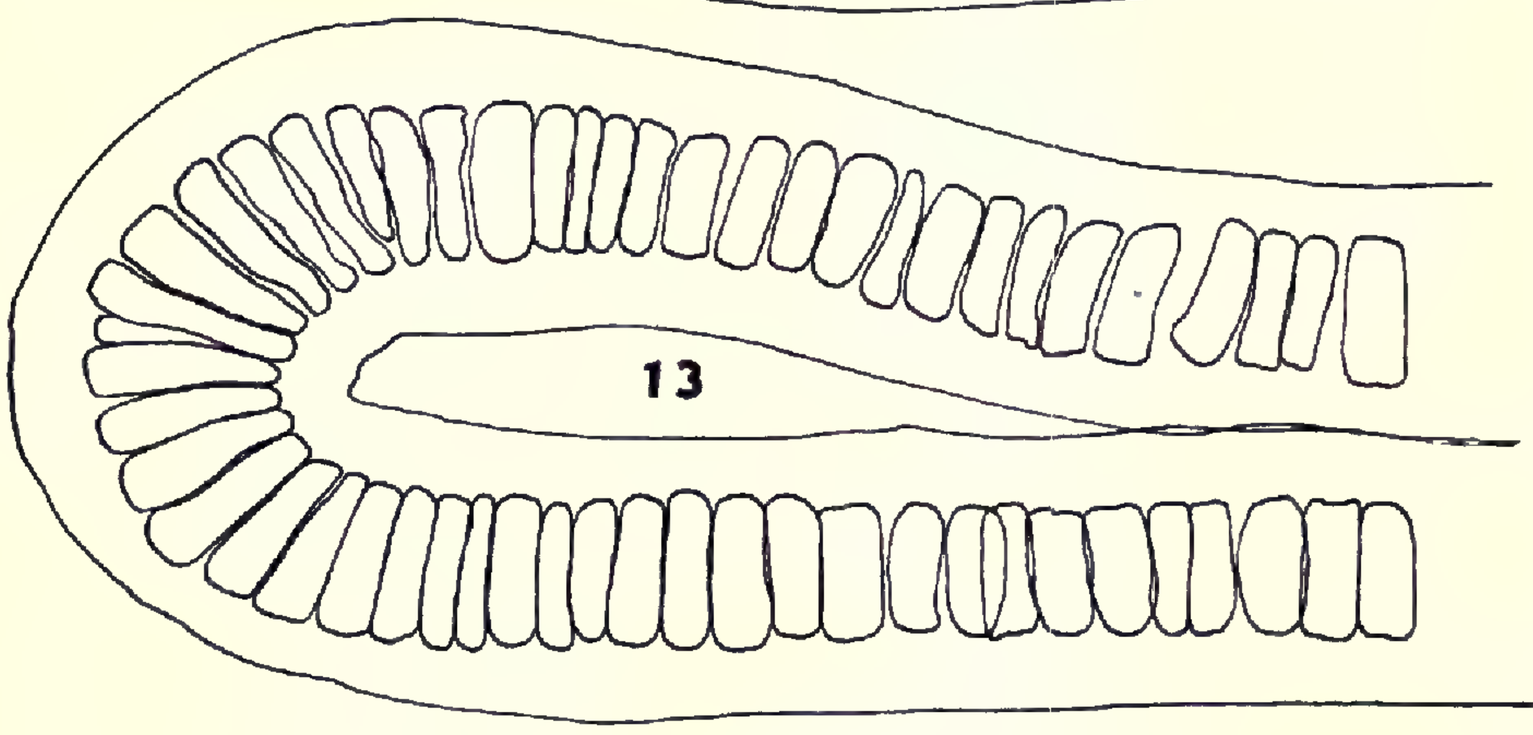
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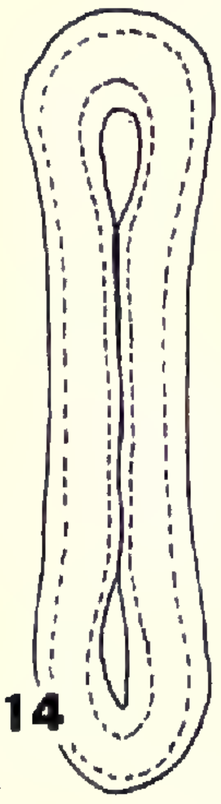
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PLATE 1

EXPLANATION OF PLATE 2

All figures are drawn with the aid of a camera lucida. The name and number in parentheses after the specific name identifies the material from which the drawing was made. The magnification is indicated at the end of each figure description.

Fig. 1–2. *Ulva stenophylla* (*MD 6126*).
1. Blade margin from the upper portion of a mature frond. × 256.
2. A portion of the center of the same thallus. × 256.

Fig. 3. *Ulva fenestrata* (*MD 2690*). Cross section through central portion of blade. × 300.

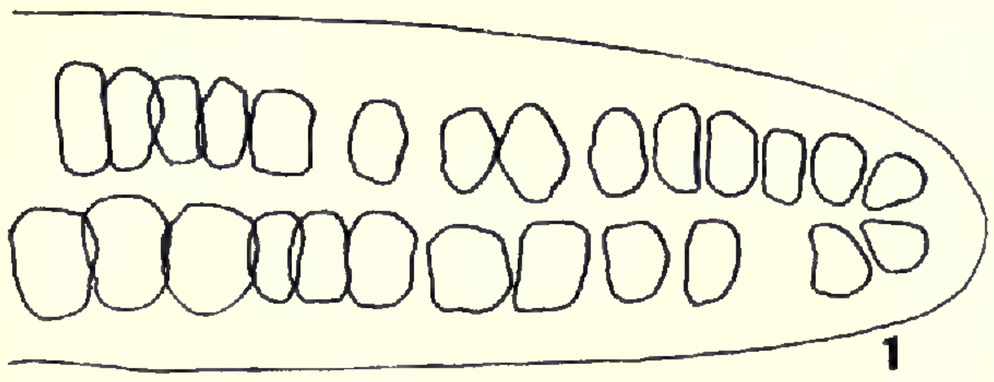
Fig. 4–5. *Monostroma zostericola* (*O'Neal 227*).
4. Cells in surface view. × 465.
5. Cross section through center of thallus. × 465.

Fig. 6–10. *Ulva californica* (*Univ. Calif. Herb. 77933*).
6–7. Cross section of thallus margin. × 210.
8. Cross section through center of blade. × 256.
9. Cross section through stipe. × 62.
10. Cross section through margin of thallus near base. × 256.

Fig. 11–12. *Ulva taeniata* (*O'Neal 435*).
11. Cross section through blade center. × 232.
12. Cross section of central portion of the base. × 232.

Fig. 13–14. *Monostroma oxyspermum* (*MD 6136b*).
13. Cross section of edge of blade. × 336.
14. Surface of central portion of thallus. × 336.

Fig. 15. *Monostroma oxyspermum* (*MD 4924*). Cross section of thallus. × 550.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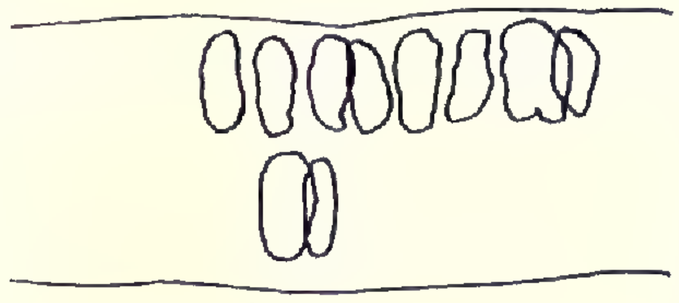
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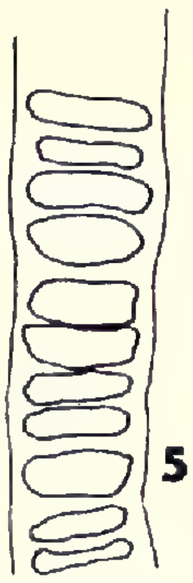
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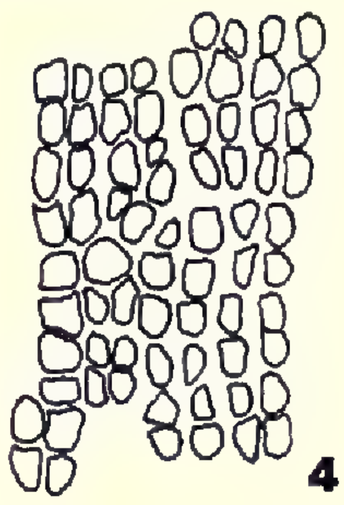
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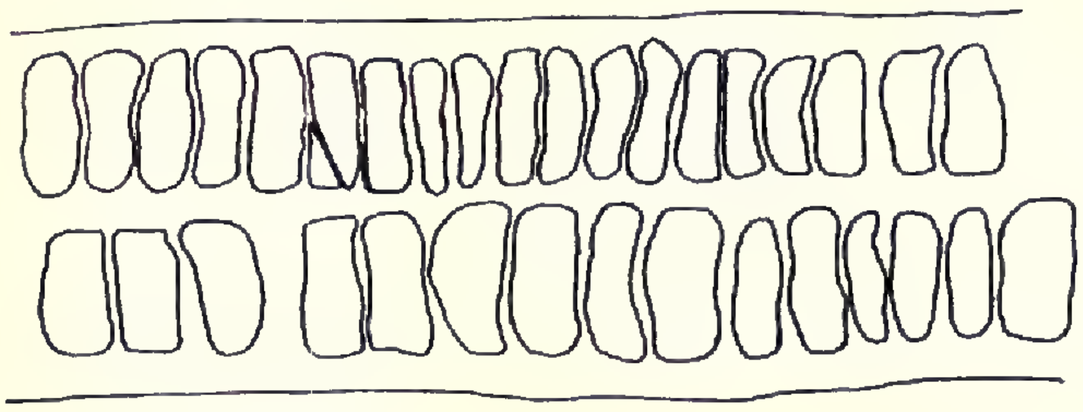
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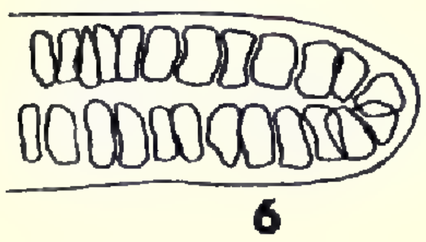
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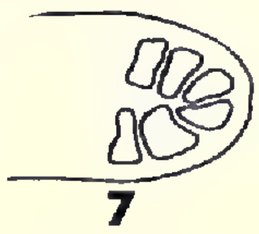
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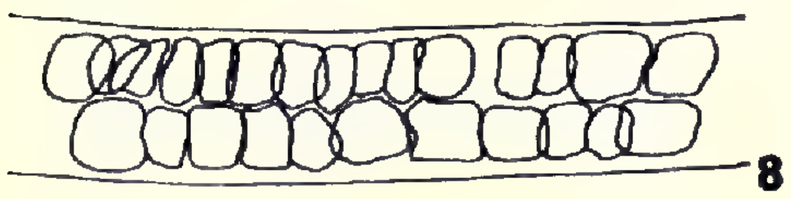
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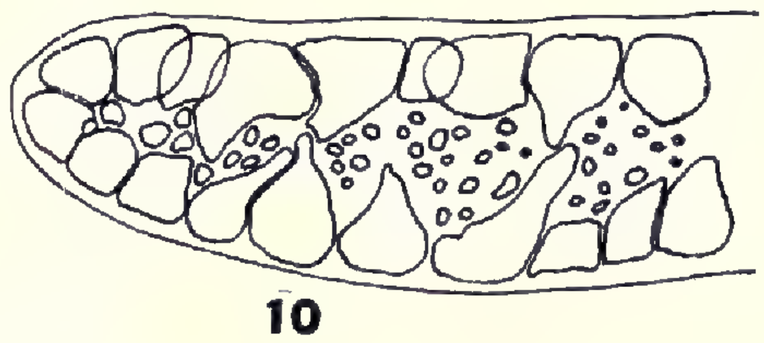
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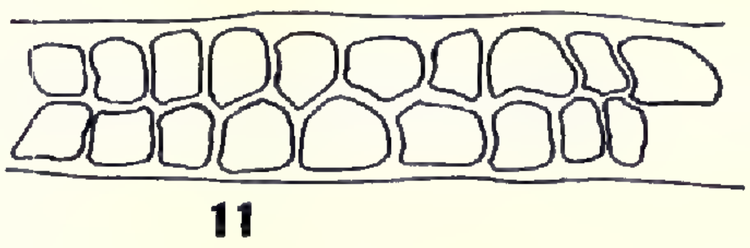
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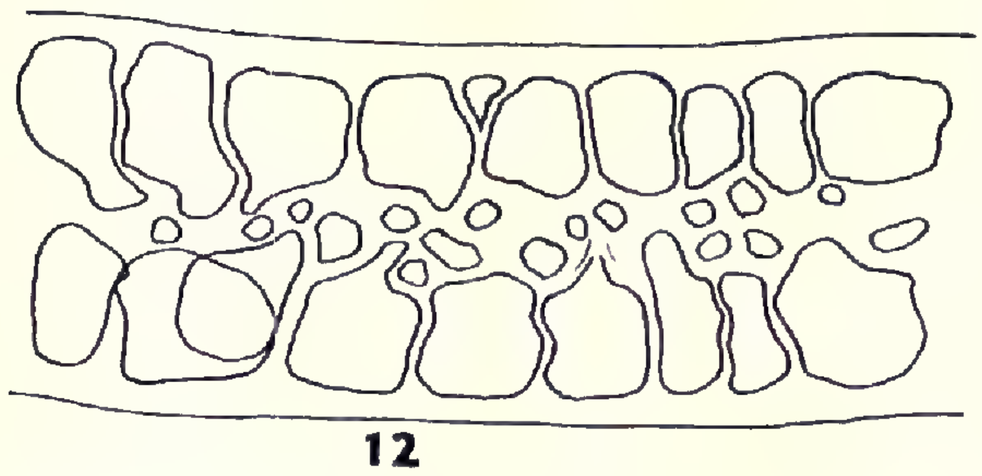
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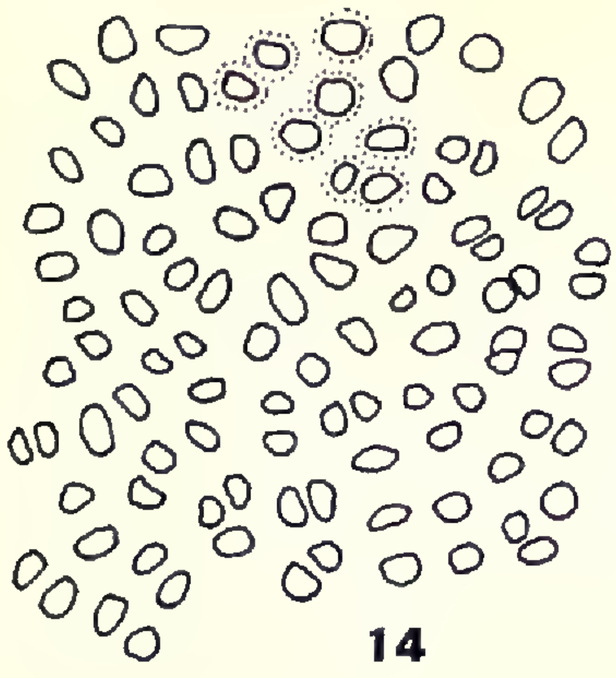
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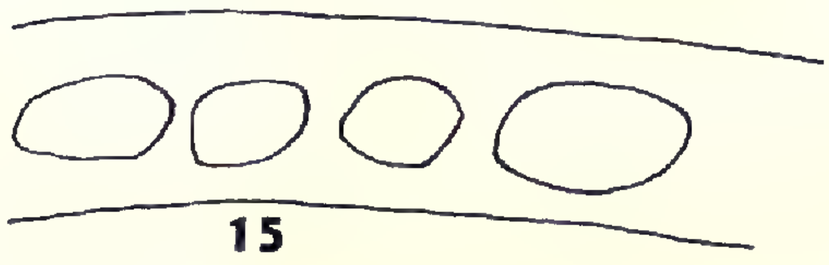
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PLATE 2

EXPLANATION OF PLATE 3

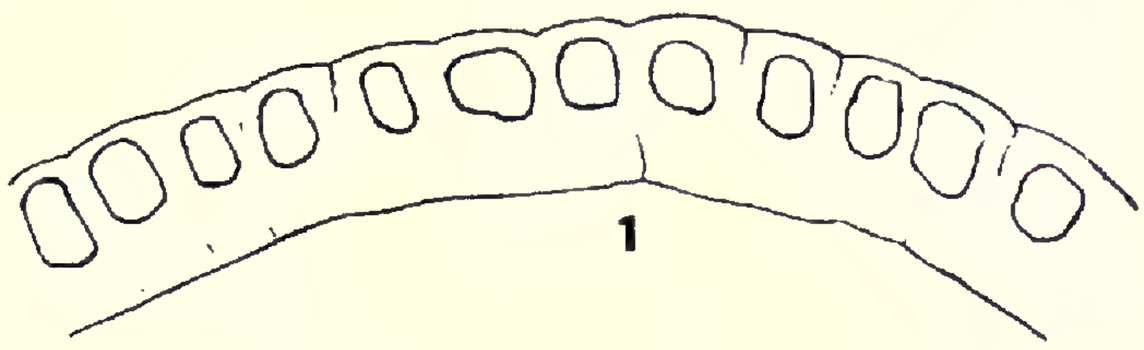
All figures are drawn with the aid of a camera lucida. The name and number in parentheses after the specific name identifies the material from which the drawing was made. The magnification is indicated at the end of each figure description.

Fig. 1–2. *Enteromorpha minima* (*MD 6211*).

1. Cross section of thallus. × 385.
2. Cell arrangement on the surface. × 385.

Fig. 3–4. *Enteromorpha minima* (*MD 5992*). Similar cross section and surface arrangement of the cells. × 440 and × 385 respectively.

Fig. 5–7. *Cladophora delicatula* (*Gardner 2747*). Drawings to show the trichotomies peculiar to this species. × 1800.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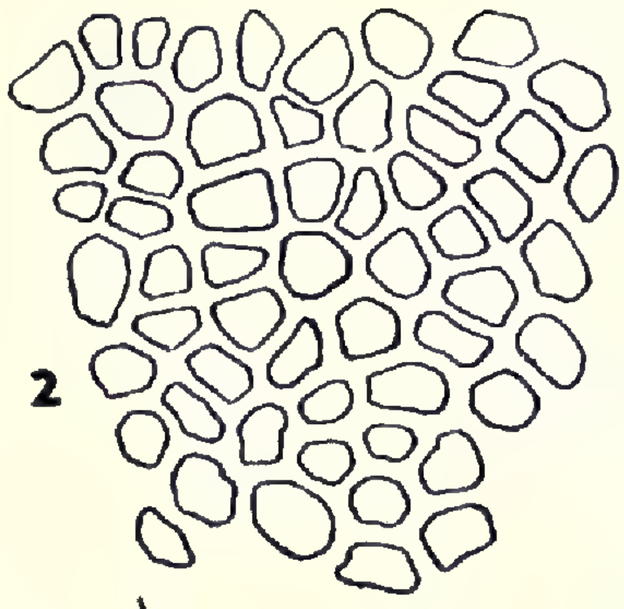
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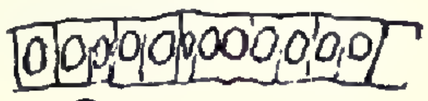
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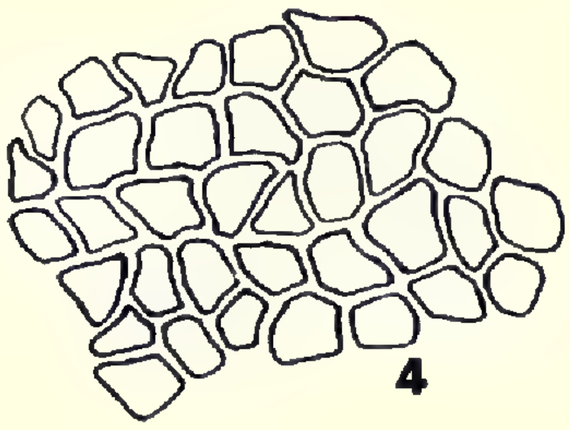
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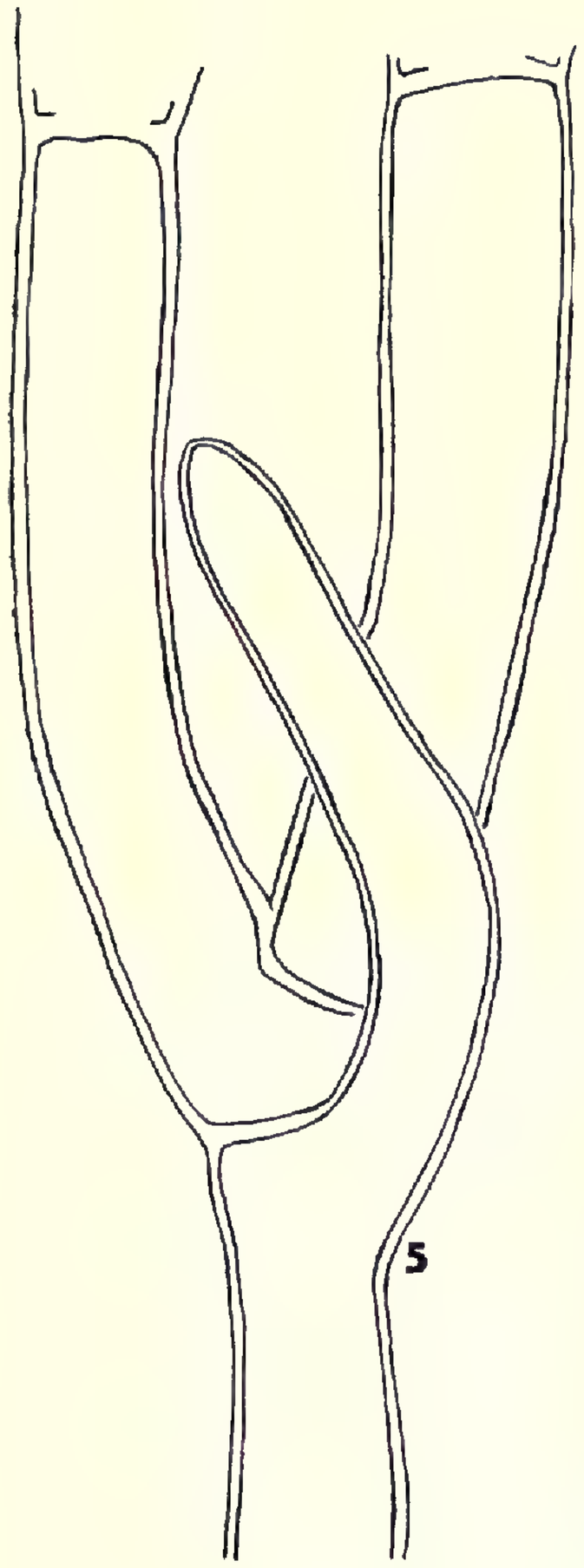
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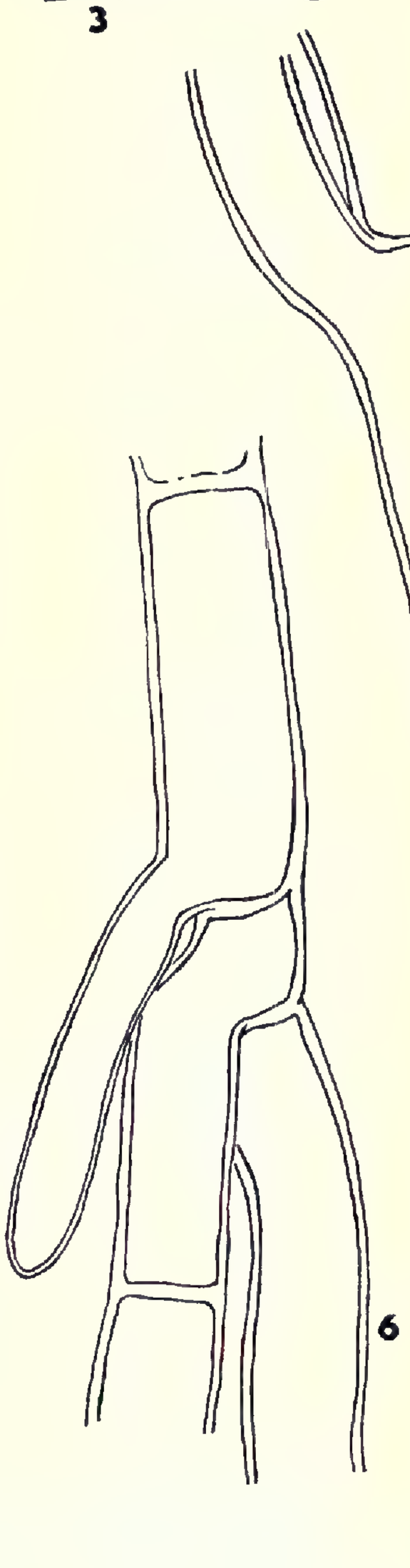
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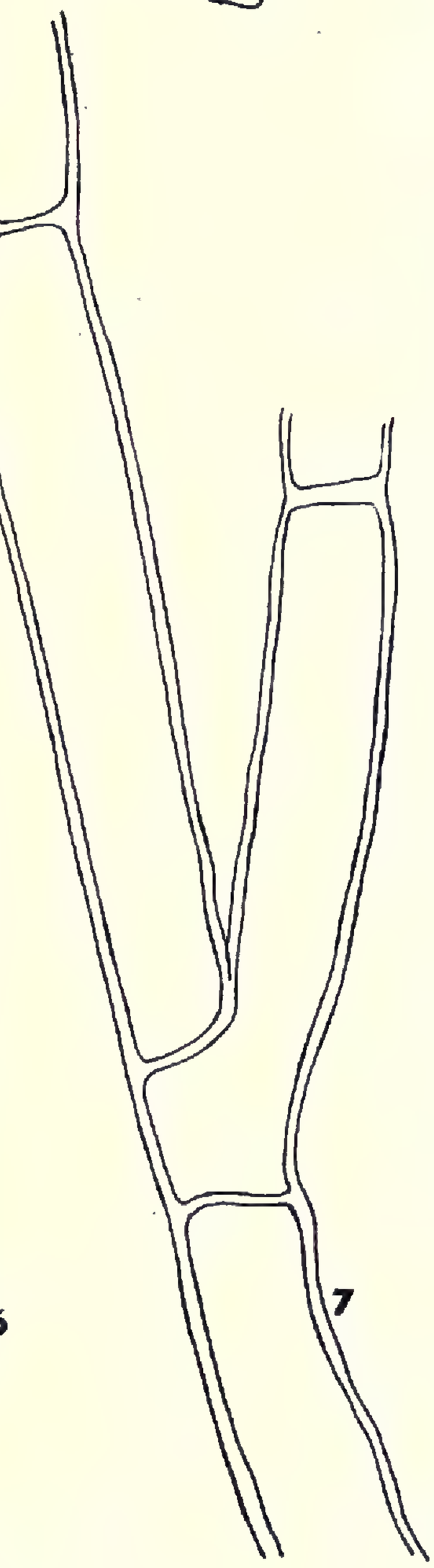
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PLATE 3

EXPLANATION OF PLATE 4

All figures are drawn with the aid of a camera lucida. The name and number in parentheses after the specific name identifies the material from which the drawing was made. The magnification is indicated at the end of each figure description.

Fig. 1. *Cladophora hemispherica* (*Gardner 4620*). Showing the branching and shape of the basal cells of the branches. × 232.

Fig. 2. *Cladophora delicatula* (*Gardner 2747*). Showing in particular the development of the characteristic trichotomies. × 730.

Fig. 3–4. *Ulva taeniata* (*C. L. Doty 1998*). Cross section of thallus margin and view of surface arrangement of cells near margin. × 320.

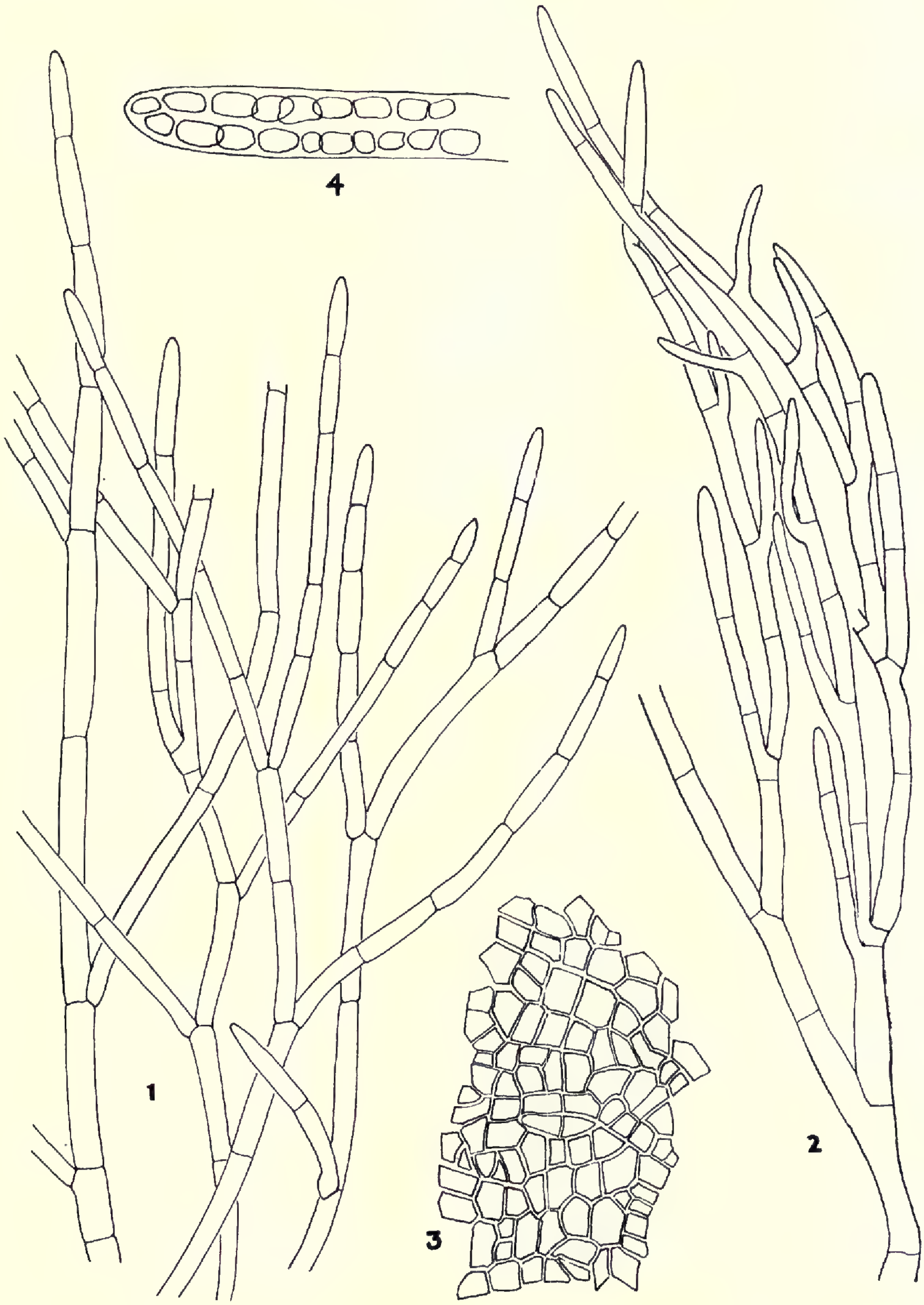

PLATE 4

EXPLANATION OF PLATE 5

All figures are drawn with the aid of a camera lucida. The name and number in parentheses after the specific name identifies the material from which the drawing was made. The magnification is indicated at the end of each figure description.

Fig. 1. *Spongomorpha spinescens* (*MD 4550*). Illustrating the simple hooked branches, spiny branches, and blunt tips. × 520.

Fig. 2–4. *Hormidium rivulare* (*MD 4716*). Illustrating some of the larger rhizoids and the Stichococcus-like cells associated with them. × 730.

Fig. 5. *Spongomorpha spinescens* (*MD 4550*). Rhizoidal branchlet. × 520.

Fig. 6. *Spongomorpha spinescens*. Habit sketch. Reduced × 3/5.

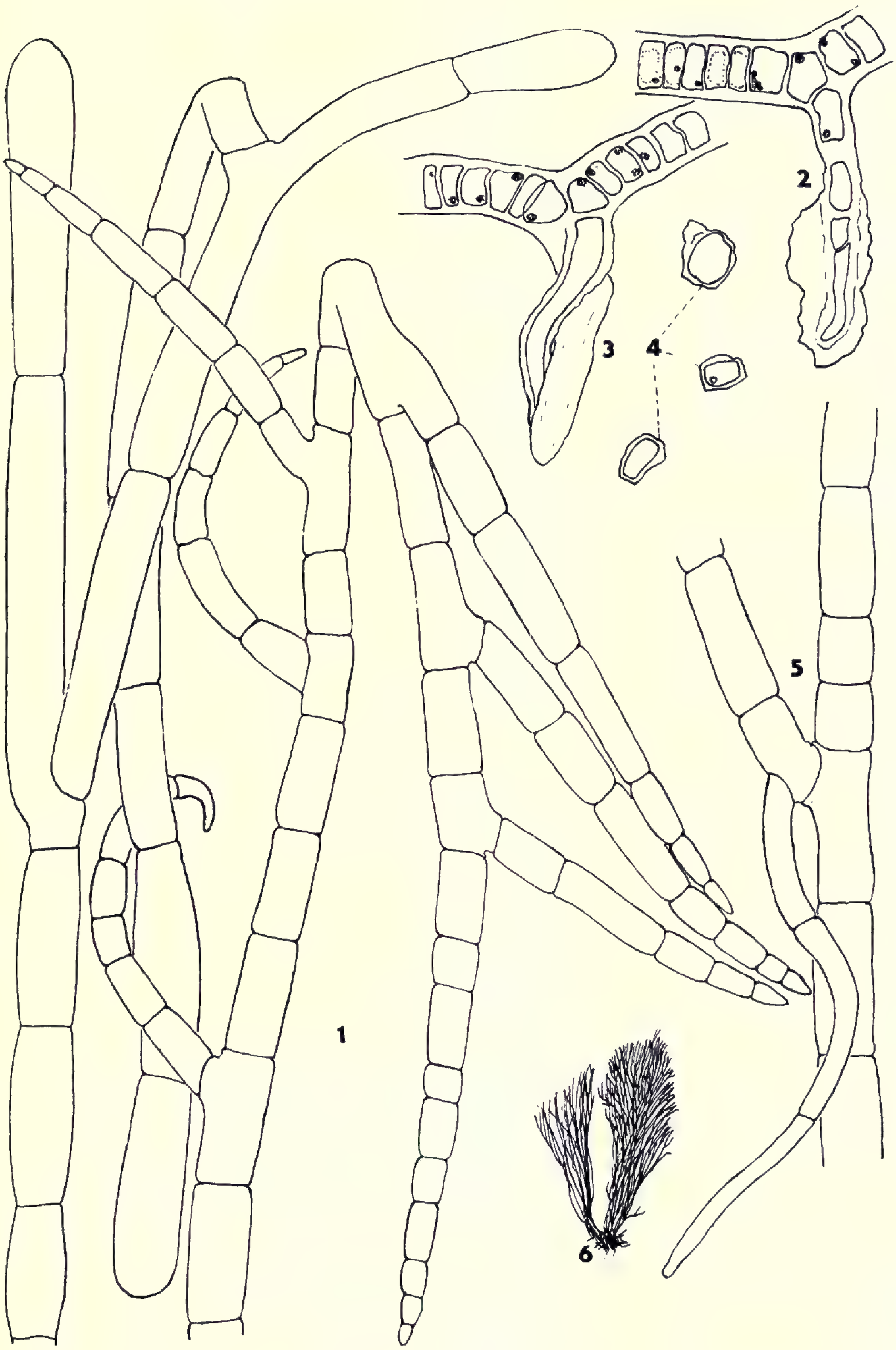

PLATE 5

EXPLANATION OF PLATE 6

All figures are drawn with the aid of a camera lucida. The name and number in parentheses after the specific name identifies the material from which the drawing was made. The magnification is indicated at the end of each figure description.

Fig. 1–9. *Hormidium rivulare* (*MD 4716*). Illustrating the origin of rhizoids. × 230.

Fig. 10–12. *Spongomorpha Mertensii* (*Gardner 4446*). Illustrating the compound hooked branchlets, some of which are rhizoidal in nature. × 740.

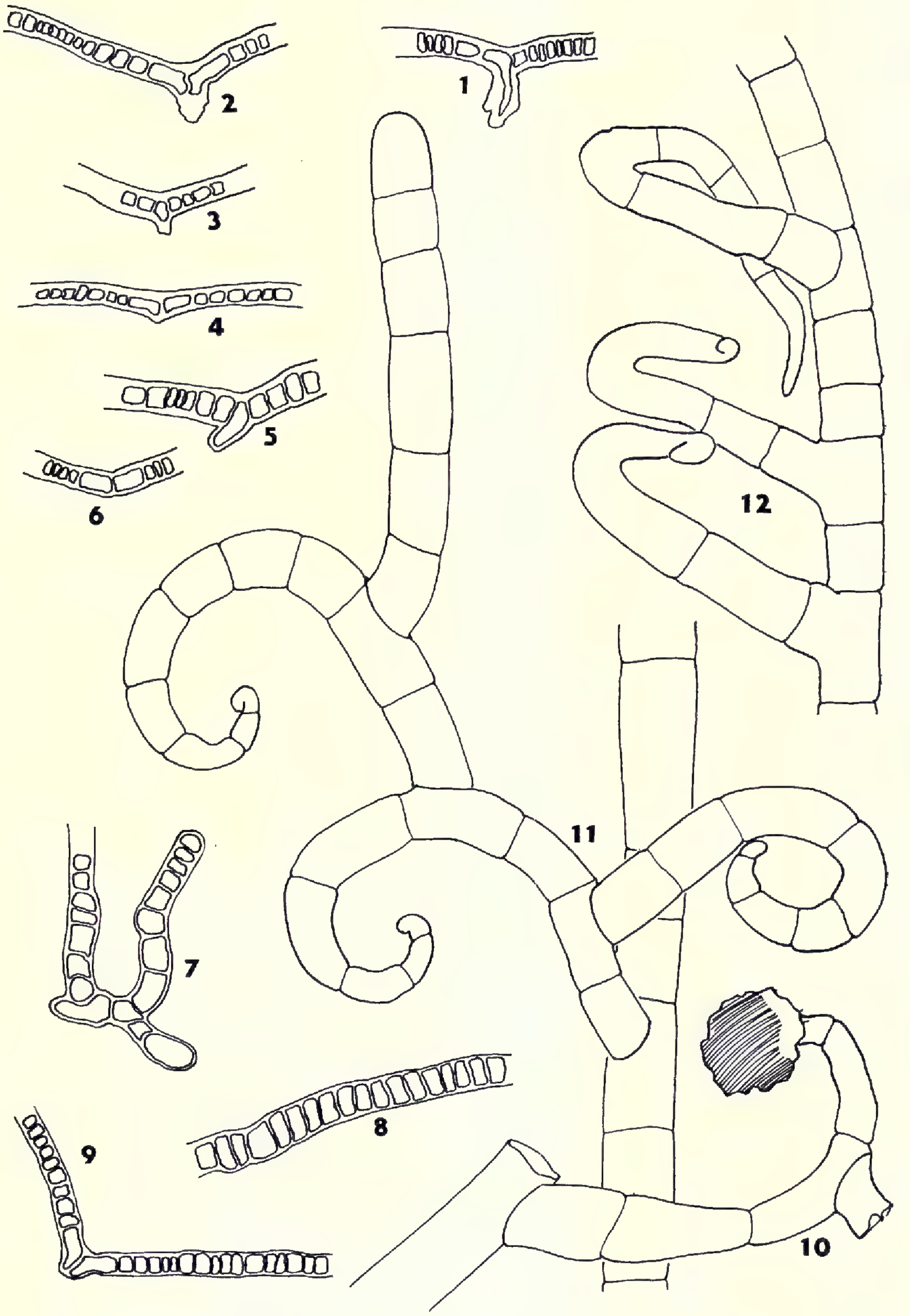

PLATE 6

EXPLANATION OF PLATE 7

All figures are drawn with the aid of a camera lucida. The name and number in parentheses after the specific name identifies the material from which the drawing was made. The magnification is indicated at the end of each figure description.

Fig. 1–2. *Urospora grandis* (*MD 2230*). × 270.

Fig. 3, 5–8. *Urospora doliifera* (*MD 6134*). × 710.

Fig. 4. *Urospora penicilliformis* (*MD 4129*). × 320.

Fig. 9. *Urospora Wormskjoldii* (*MD 2006*). × 51.

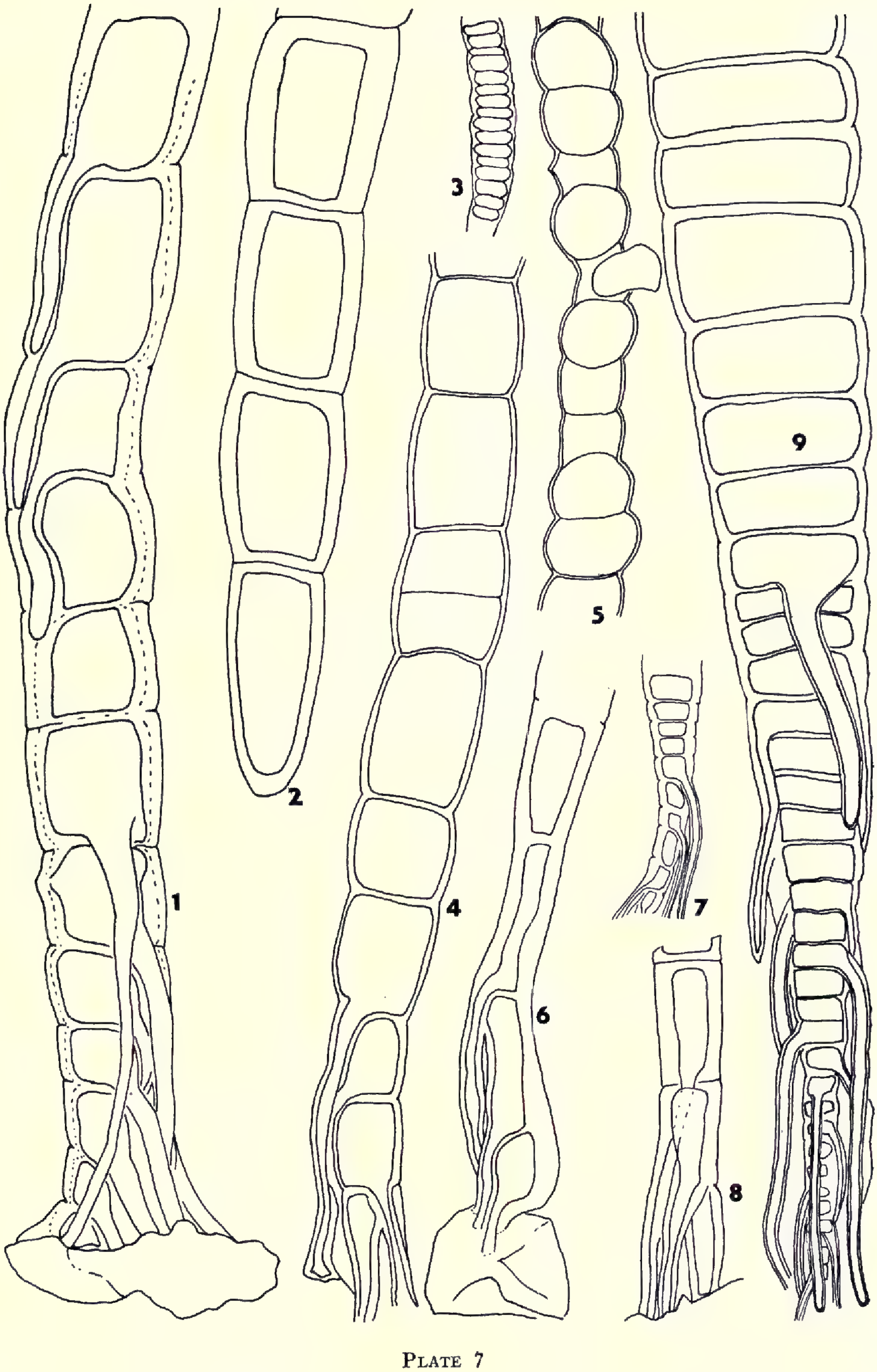

PLATE 7

EXPLANATION OF PLATE 8

The name and number in parentheses after the specific name identifies the material from which the photographs were made. The magnification is indicated at the end of each figure description.

Fig. A. *Ectocarpus Haplogloiae* (*MD 2491*, **isotype**). × 0.5.

Fig. B. *Ulva linza* var. *oblanceolata* (*O'Neal 433*, **cotype**). × 0.27.

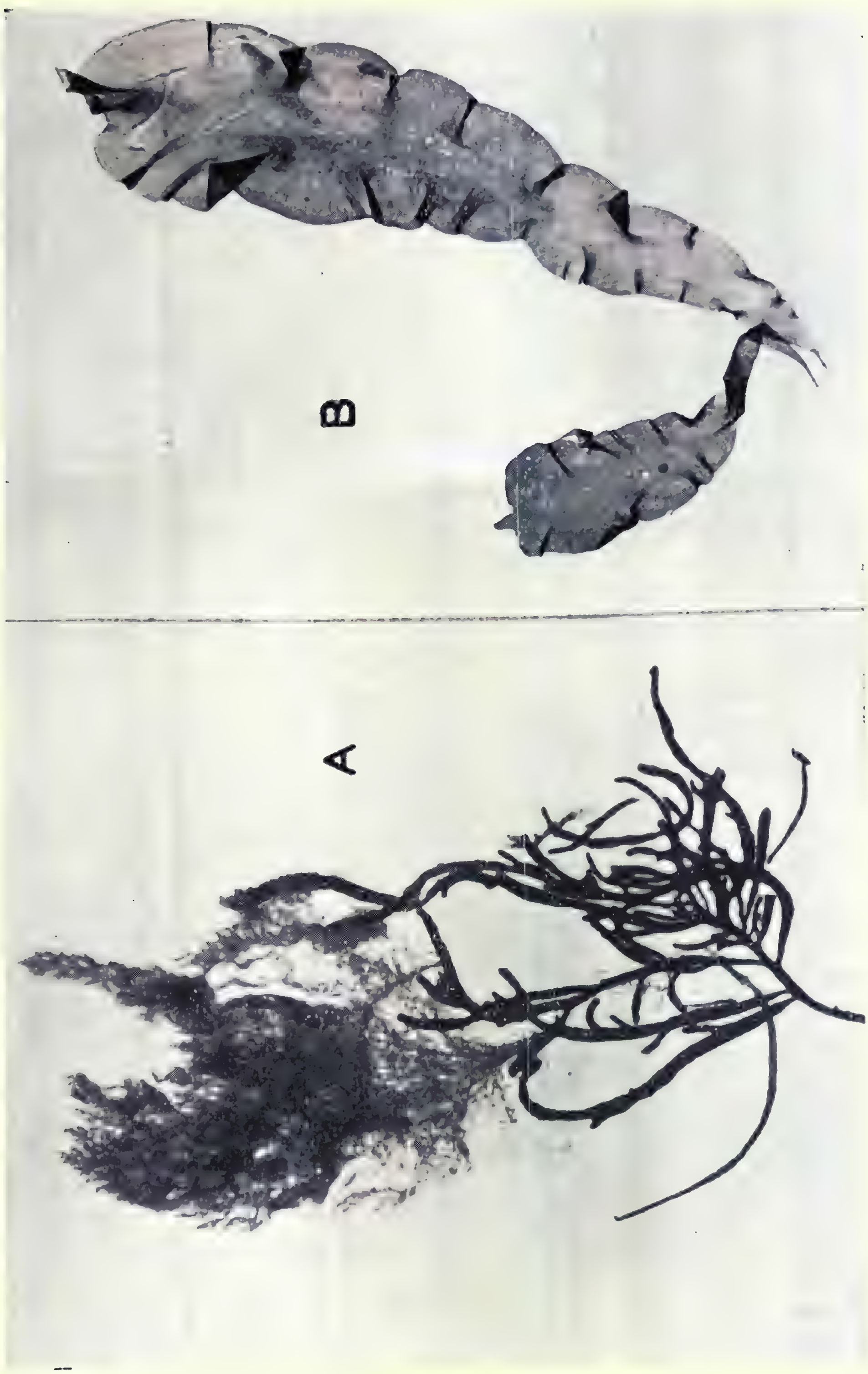

PLATE 8

EXPLANATION OF PLATE 9

The name and number in parentheses after the specific name identifies the material from which the photographs were made. The magnification is indicated at the end of each figure description.

Fig. A. *Scytosiphon attenuatus* (*MD 2544*). × 0.25.

Fig. B. *Scytosiphon complanatus* (*O'Neal 422a*). × 0.19.

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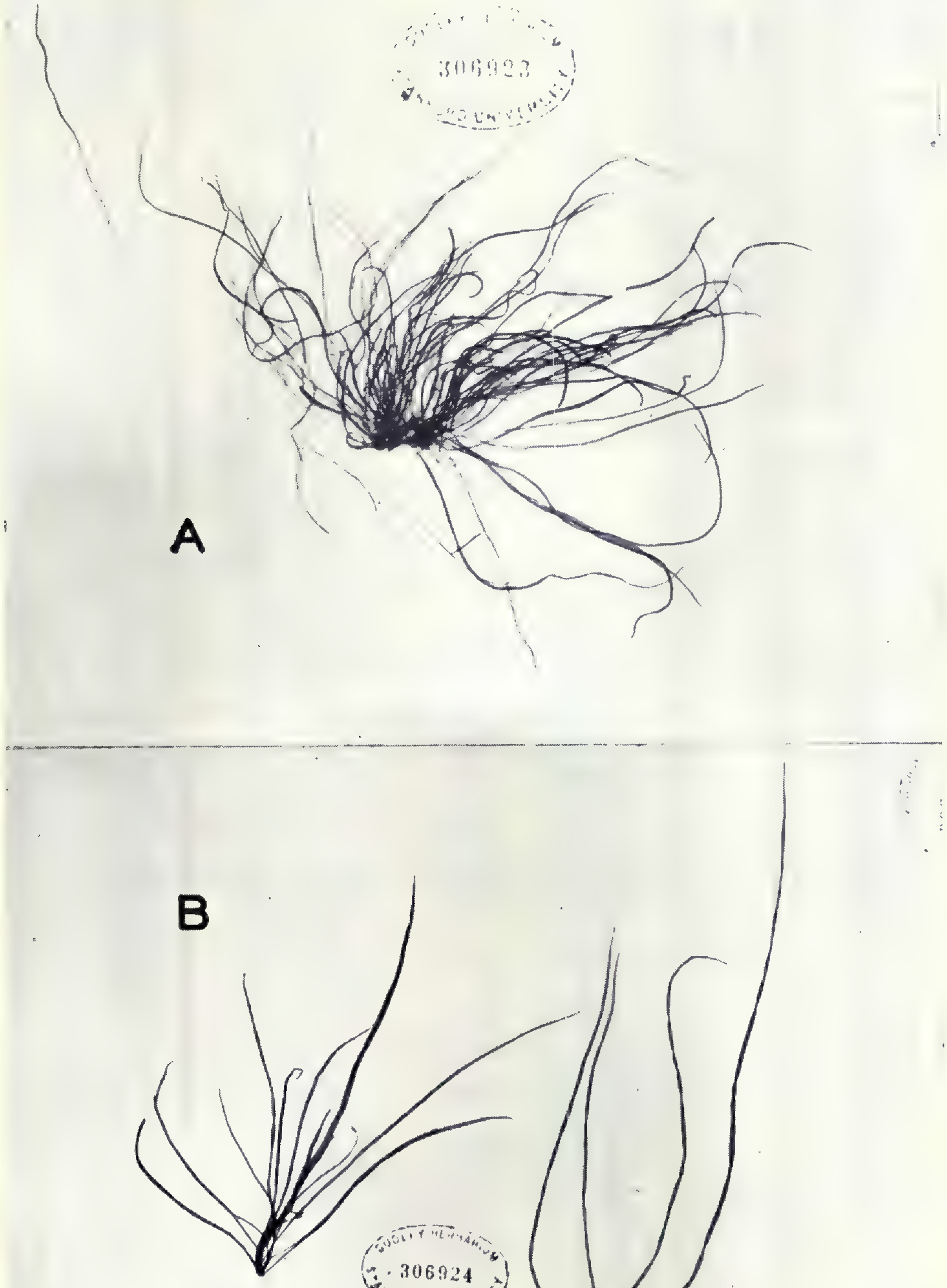

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PLATE 9

EXPLANATION OF PLATE 10

The name and number in parentheses after the specific name identifies the material from which the photograph was made. The magnification is indicated at the end of the figure description.

Laminaria ephemera (*C. L. Doty 1949*). × 0.16.

1949 Laminaria (D. Herb. 11-2-'65)

Like ectype of Postelsia palmaeformis and like Carmel Bay specimens labeled this by Setchell

PLATE 10

3(1):67–71 FARLOWIA JANUARY, 1947

A NOTE ON A CHARA NEW TO THE PHILIPPINE ISLANDS

ROY M. WHELDEN

Among the undetermined species of *Chara* in the Farlow Herbarium collection was one which was sharply distinct from all the others in its complete lack of either cortication or incrustation. Brief examination showed the plant to be dioecious and to have a stipular crown formed of a single row of cells. Very few Charas having this combination of characters have been described, making rather easy the problem of identification of the species.

The only two species thus limited that have been described are *Chara australis* R. Brown (with a subspecies *plebeja* (R. Brown) A. Braun) and *Chara Wallichi*, these two differing in the nature of the bracts of the leaf nodes, those of *Chara australis* being very short or even practically lacking while the leaf bracts of *Chara Wallichi* are as long as the sporangia. The sporangia are also distinct in the two species, those of *Chara australis* having low rounded ridges, those of *Chara Wallichi* having the ridge very prominent.

Robert Brown's original very brief description (1810) of *Chara australis* was based on a plant from Australia: the plant was ecorticate, with the lower whorls of leaves far apart, leaves articulate; dioecious. Alexander Braun mentioned this species in many of his papers on Characeae (1849, 1852, among others); he described it in a footnote on p. 148 in Plantae Preissianae (1846). Here he stated that the plant was completely ecorticate, pliant, with the lower leaf whorls remote, the upper close together; composed of rather thick leaves of three nearly equal segments, the last tipped with a minute mucro; both at the base and at the joints of the leaves bracts are almost lacking; the large antheridia are grouped at the joints; dioecious; sporangia unknown. Both Kützing (1849) and Wallman (1853) give practically the same description. In Tab. Phycol. (1857) Kützing figures, not very satisfactorily, some branches at natural size (as *Nitella australis*).

In 1883 Nordstedt prepared Braun's manuscripts for final publication and presented all the information contained therein on this species. In these he presented three varieties of *Chara australis*, namely var. *nobilis*, var. *lucida*, var. *Viellardi*. The sporangia of var. *lucida* are described as having very broad spiral ridges which are very hard to see. In this variety the leaf bracts are described as distinctly visible; otherwise the three varieties are described much as in earlier descriptions, but with dimensions given. The species is known to have been found in Australia, Tasmania, New Zealand and New Caledonia.

The occurrence of a similar *Chara* in the Philippine Islands is of some interest. The specimen, collected at a fountain near San Juan, Rizal, in May 1940 by G. T. Velasquez, shows a tangled mat about 7 cm. across,

formed of parts of several plants, so intricately mingled as to make disentanglement extremely difficult. Several small branch tips were removed and mounted. Some of these branches bear mature sporangia, others have antheridia in various stages of development, while the greater number are quite sterile. It is entirely ecorticate and has no sign of incrustation even on the sporangia, and appears quite glossy and brownish-yellow in the dried condition. The stem segments are straight, cylindrical, up to 3 cm. in length and 860 μ in diameter (Fig. 1). The leaves are borne 6–9 in a whorl, each leaf being formed of 2–4 cylindrical segments and constricted slightly at the joints. (Fig. 2 a, b.) In most cases the ultimate leaf segments are tipped by 1–3 conical cells, the longest measuring 170 μ in length. (Fig. 7 a, b, c, d.)

The stipular crown contains but a single row of cells, usually of the same number as the leaves in the whorl and alternating with their bases, (Fig. 3 b, c) but sometimes being twice the number of the leaves, a pair of stipules then occurring between adjoining leaf bases. (Fig. 3a.) The stipules are upward directed elongate conical cells 160–220 μ long. The sporangia and antheridia are borne on the lower 1–3 nodes of the leaves, (Fig. 2 a, b.) and also frequently occur at the base of the leaf, in which instance the sporangia form a beautifully symmetrical ring about the stem. The sporangia usually occur singly at each node, the antheridia more frequently are paired. Single antheridia occur usually only at the distal fruiting node. The mature sporangia are 710–820 μ long and 690 μ in diameter and have 6–7 spiral cells (Fig. 4). The oöspore is very firm, black and 585 μ long and 490 μ in diameter and shows 6 very low rounded spiral ridges. (Fig. 5) The mature antheridia are up to 720 μ in diameter (Fig. 6), though usually under 650 μ, and orange-colored.

The leaf bracts, always present at every node, show some variation in number and size, but are always rather small and inconspicuous. In sterile leaves the number is from three to five bracts of unequal size at each node, the longest being on the inner side of the leaf. In antheridia-bearing leaves the bracts are usually 2 or 3 of approximately equal size. (Fig. 6) They occur on the opposite side of the leaf from the antheridia. Frequently there are, in addition to the bracts, 2–3 minute spherical cells present at the same node. In sporangia-bearing leaves the bracts show greater variation in number and size; usually there are 5–7 bracts uniformly arranged about the node, the longest subtending the sporangium. Occasionally all bracts at a single sporangium-bearing node are about equal in length. The length varies from 300–480 μ but never exceeds one-third of the length of the sporangium.

The Philippine plant described above is *Chara australis* R. Brown, differing in no material point from any of the early descriptions of this species. A close examination of the specimen shows that in many ways it is a very variable plant. The same fact is indicated by the recorded though minor differences in the several early descriptions. Because of this variability it does not seem wise to set off the Philippine plant as a

variety. Its occurrence in the Philippine Islands extends greatly the known range of *Chara australis* R. Brown.

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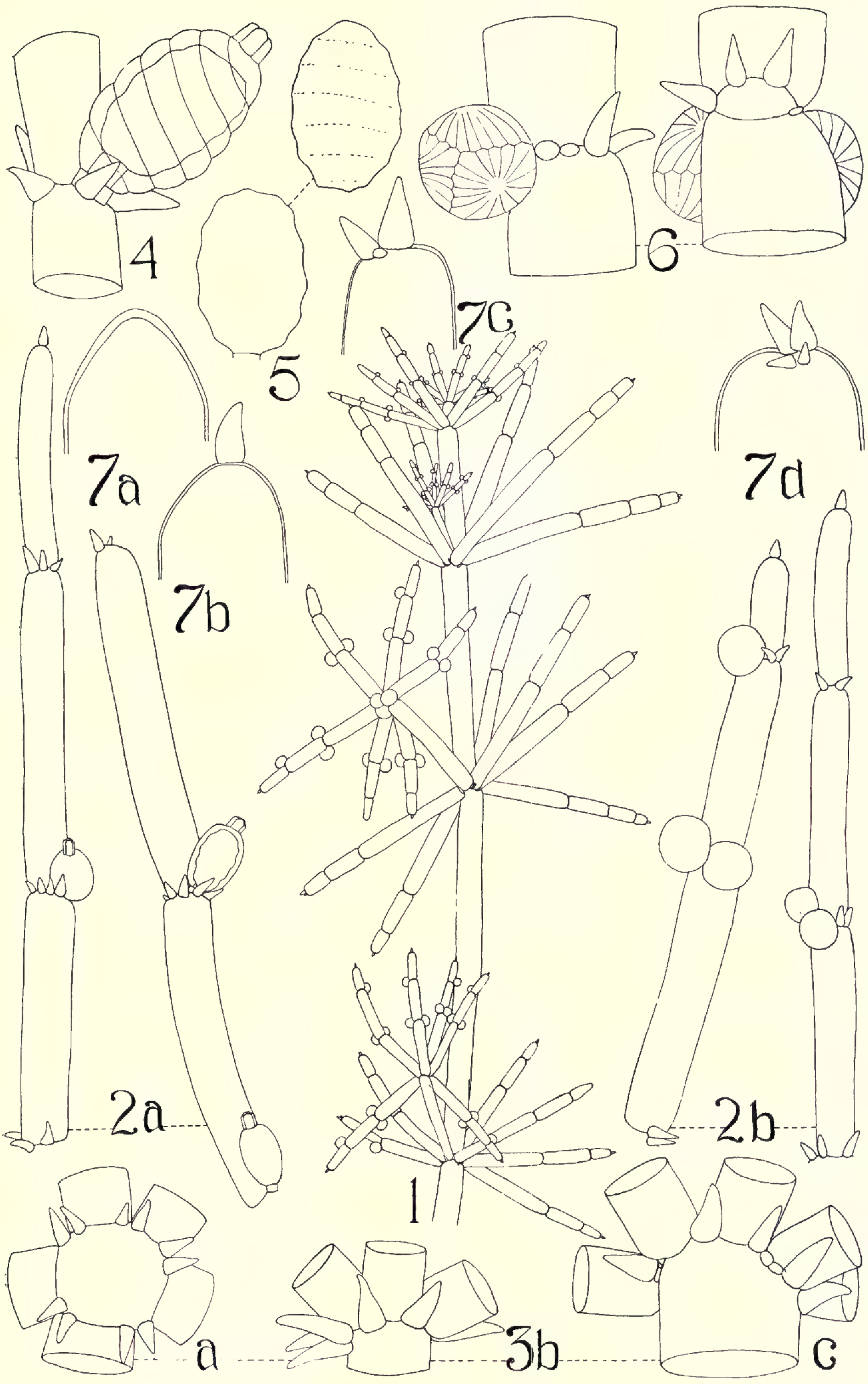
BIBLIOGRAPHY

Braun, A. C. H. (1846) Plantae Preissianae. vol. 2, fasc. 1, p. 148 (footnote).
———. (1849) Charae Australes et Antarcticae. in Hooker's Jour. Bot. **1:** 193–203.
———. (1852) Plantae Muellerianae. Linnaea **25:** 704–709.
———. (1883) Fragmente einer Monographie der Characeen. Edited by O. Nordstedt. Abhandl. K. Akad. Wiss. Berlin 1882: 211 pp. 7 pl.
Brown, Robert (1810) Prodromus Florae novae Hollandiae et insulae Van Diemen p. 346.
Kützing, F. T. (1849) Species algarum. p. 519.
———. (1857) Tabulae Phycol. vol. 7, pl. 27, fig. II.
Wallman, J. (1853) Försäk till en systematisk uppställning af växtfamiljen Characeae. Vetensk. Akad. Handl. för 1852, p. 519.

EXPLANATION OF PLATE

All figures were drawn with the aid of a camera lucida.

Fig. 1. Tip of branch of male plant.
Fig. 2a. Sporangia-bearing leaves, showing bracts.
Fig. 2b. Antheridia-bearing leaves, showing bracts.
Fig. 3a. Stipular crown with two stipules at base of each leaf.
Fig. 3b–c. Stipular crown with single stipules alternating with leaf bases.
Fig. 4. Sporangia, showing bracts.
Fig. 5. Oöspores.
Fig. 6. Antheridia, showing bracts.
Fig. 7a–d. Leaf tips, showing variation of apical mucro.


4
5
6
7c
7a
7b
7d
2a
2b
1
a
3b
c

3(1):73–93 FARLOWIA JANUARY, 1947

CRITICAL OBSERVATIONS ON THE USTILAGINACEAE

ELISA HIRSCHHORN [1]

There has been a strong tendency for many years for mycologists and phytopathologists to place too much emphasis on slight morphologic variations and on host specialization as criteria for the identification of parasitic species of fungi. This has given rise to the description of many species which do not even represent different physiologic forms, to say nothing of different varieties or species. The taxonomic literature is replete with species based upon slight biometric differences or on their physiological specialization to a single genus or species of host plant. A parallel case is furnished by the treatment of the smuts which grow on species of *Polygonum* and to a certain extent, those on *Carex* spp. and *Rhynchospora* spp. Such criteria, however, must now be revalued since it is known that the fungus species are made up of physiologic forms which differ only in their capacity to attack certain host plants and not others. Furthermore there is some evidence that the environment has a great deal to do with the variation of morphologic and physiologic characteristics of pathogenic fungi.

In the present paper the writer furnishes evidence of the morphologic similarity of some species of *Ustilago* and *Cintractia* which had formerly been considered, on the grounds mentioned above, to be distinct. These studies have been based for the most part on type or authentic specimens.

SPECIES OF USTILAGO ON GRAMINEAE

1. **Ustilago hypodytes** (Schlechtendal) Fries, Syst. Mycol. **3:** 518. 1829.

PLATE I, FIG. E

Sori surrounding the internodes, sometimes extending into the abortive inflorescence, naked. Chlamydospores olivaceous, brown, globose or subglobose, 4–7 μ diam.; epispore smooth.

HOSTS: *Elymus arenarius* L. and *Elymus* sp.

SPECIMENS EXAMINED: **Germany:** Borussia, near Berlin, on *Elymus arenarius*, Oct. 1884, *P. Sydow in* Rabenhorst: Fungi Europ. Ser. 2, No. 3201 (FH). — Grunewald, Berlin, Aug. 1884, *P. Sydow in* P. Sydow: Mycotheca Marchica, No. 5222 (FH). — **England:** Broughty Fenn, on *Elymus* sp., *Sadler in* Cook: Fungi Britannici Exsic. No. 33 (FH). (In this specimen there are a very few chlamydospores, approximately one in one thousand, which have slight bipolar crests.)

Fischer and Hirschhorn (3) have furnished evidence that the great majority of the collections of the stem smuts on grasses from all over the

[1] This work was done as a Guggenheim Fellow at the Farlow Herbarium, Harvard University. The writer wishes to express her deep appreciation to Dr. David H. Linder for his kindness in providing access to the herbarium, for his photographic assistance, and for correction of the manuscript.

world which have been considered to be *Ustilago hypodytes* are in reality *U. Spegazzinii* Hirschhorn, *U. Spegazzinii* var. *agrestis* Fischer & Hirschhorn, *U. Williamsii* Griffith and *U. halophyla* Speg. These authors, after examination of hundreds of specimens, including a topotype of the so-called *U. hypodytes*, proved that the species is not so widely distributed as it was formerly thought, and that the species which was considered to be *U. hypodytes* was in reality a species complex. The impossibility of obtaining the type specimen and the lack of a complete original diagnosis led to the conclusion that *U. hypodytes* is a *nomen dubium* or *nomen ambiguum*.

According to several mycologists, *U. hypodytes* possesses smooth chlamydospores, but careful observations have demonstrated that almost all the specimens studied have chlamydospores that are slightly pitted and provided with bipolar hyaline or concolorous crests which are characteristic of *U. Spegazzinii* or its variety *agrestis*. Neither Schlechtendal nor Fries makes reference to the bipolar crests in their original descriptions, the only helpful reference being that the species is based on a specimen collected near Berlin on *Elymus arenarius*.

Recent examination of the immensely rich collections at the Farlow Herbarium, Harvard University, permitted the writer to extend her observations on numerous additional collections of stem smut on grasses, among which was one from Berlin on *Elymus arenarius*. This specimen agrees with the original description in that it possesses smooth chlamydospores that are devoid of pitting, or lack the bipolar crests, and hence agree perfectly with the original description. Since the name *Ustilago hypodytes*, because of the recent gains in knowledge concerning the species of stem smuts on grasses, becomes a *nomen dubium*, it is desirable to clarify the species and to select a lectotype. It is therefore proposed that the specimen on *Elymus arenarius* (the type host) and collected by P. Sydow near Berlin in October, 1884 be chosen as the lectotype. Such a choice has the advantage that the species was widely distributed in Rabenhorst's Fungi Europea, Ser. 2 as number 3201.

Ustilago nummularia Spegazzini (7) on *Stipa speciosa* possesses characters that are very similar to those of *U. hypodytes*, differing only in that some of the chlamydospores are slightly papillose. For this reason, *U. nummularia* should perhaps be considered a synonym of *U. hypodytes* or at most a variety of that species.

2. **Ustilago minima** Arthur, Bull. Iowa Agr. Coll. 1884:172. 1885.
Ustilago Stipae Ciferri, Ann. Mycol. **29:** 52. 1931.

Sori surrounding the internodes or occasionally the aborting inflorescence, covered by a whitish fungous membrane. Chlamydospores brown to light brown, 3–5 μ diam.; epispore smooth.

HOST: *Stipa spartea* Trin.

As was reported by Fischer and Hirschhorn (3), one of the specimens used for the description of *U. Stipae* Ciferri, on *Stipa spartea*, did not

agree with the characters in the original description because the chlamydospores possess the bipolar crest that is typical of *U. Spegazzinii*. Studies of the other specimens (Seymour & Earle: Econ. Fungi, No. C70 and U. S. Bureau of Plant Industry, Mycological Exchange of 1921, on *Stipa spartea*, Ames, Iowa, 9 July 1892, *F. C. Stewart*) which were used by Ciferri for his description, agree with the characters mentioned in the original diagnosis by Ciferri. The specimen in Seymour & Earle: Econ. Fungi No. C70, although not so designated, should therefore be considered the type of *U. Stipae*. It appears, however, that Ciferri overlooked the fact that in his specimen the fungus produces a sorus which is covered by a fungous membrane. This character, plus the smooth, brown chlamydospores which measure 3–5 μ in diameter, make it evident that *U. Stipae* is identical with *U. minima* Arthur, also described on *Stipa spartea*. For this reason *U. Stipae* must be considered a synonym of *U. minima*, which has priority.

3. **Ustilago Zeae** (Keckmann) Unger, Einfl. d. Bodens. p. 211. 1836.
Ustilago Euchlaenae Passerini *in* Anzi, M. *et al.* Erb. Critt. Ital. Ser. II, fasc. 23/24, No. 1125. 1882.

PLATE I, FIGS. C-D; PLATE III

Sori in different parts of the host forming galls covered by a whitish host membrane; chlamydosporic mass olive-brown to brown-black. Chlamydospores brownish olivaceous to brownish yellow, globose or subglobose, 5–20 μ diam.; epispore echinulate.

HOSTS: *Zea Mays* L. and *Euchlaena mexicana* Schrad.

SPECIMENS EXAMINED: **Germany:** *in* F. Petrak: Flora Bohem. Morav. Exsic. No. 902 (FH).—**Italy:** on *Euchlaena luxurians* (= *E. mexicana*), *Arcangeli*, 1880, *in* M. Anzi *et al.*: Erb. Critt. Ital. Ser. II, No. 1152 (FH).—**United States: Illinois:** Urbana, on *Euchlaena mexicana*, Sept. 1897, *G. P. Clinton* (FH).—**Iowa:** Ames, on *Euchlaena luxurians*, 20 Sept. 1898, *A. F. Sample* (FH).—**New York:** Ithaca, Randolf's Breeding Plots, on *Euchlaena mexicana*, *L. F. Randolf* (FH, CU–P, 19546).—**Indiana:** Cambridge City, on *Zea Mays*, 1901, *W. R. Littell* (BPI, FH).—**Uruguay:** Distr. Colonia, Estanzuela, on *Z. Mays*, 1931, *Mrs. Berger in* Herter: Plantae Uruguay. Exsic. No. 1453 (FH).—**Philippine Isds.:** Cebu, Compostella, on *Z. Mays*, Apr. 1927, *A. Derecho* (PHILIPP. NAT. HERB., 1605, FH).—**Japan:** Sapporo, on *Z. Mays*, Oct. 1889, *K. Miyabe* (FH).—**China:** Kwangsi Prov., Ling Yuin Hsien, on *Z. Mays*, 2 June 1933, *S. Y. Cheo, 2236* (FH).—Kweichow Prov., Tsunyi Hsien, on *Z. Mays*, 27 July 1931, *S. Y. Cheo, 130* (FH).

Ustilago Zeae is one of the most common parasites of *Zea Mays* and is reported frequently on *Euchlaena mexicana*. In 1882, Passerini published a descriptive note as part of the label of specimens collected by Arcangeli and issued in Anzi's *et al.* Erb. Critt. Ital. as number 1152, a point that is sometimes overlooked and has resulted in the accrediting of the species to Arcangeli. The original description is as follows: *Differt a communi Ustilagine Maydis Tul., statione sporisque vix majoribus (0.010 mik.). . . . Sporae globosae, pallide aurantio-fuscae, episporio leviter papillato, 8–10 mk. diam.* A study of the type specimen of *U. Euchlaenae* makes clear the morphologic identity of *U. Euchlaenae* and *U. Zeae*. Both form

galls which enclose a dusty, olivaceous brown chlamydosporic mass. The chlamydospores of both are olivaceous brown to olivaceous yellow, 5–11 μ in diameter, with echinulate epispore. Passerini mentioned that his species differs from *U. Zeae* because it possesses larger chlamydospores. Probably he had not observed much material of *U. Zeae* since there are cases when chlamydospores of this species reach 20 μ in diameter. The only slight difference between the two species is that *U. Euchlaenae* produces paler chlamydospores, a difference which in itself does not justify recognizing the two species as distinct, even varietally. Therefore *U. Euchlaenae*, which is a later name, should fall into synonymy and *U. Zeae* should be retained as the valid name.

Ustilago Kellermanii Clint. was included by Ciferri (1) as a synonym of *U. Euchlaenae*. Although type material of *U. Kellermanii* was not available to the writer, she was able to study material of this species, made available through the kindness of Mr. John A. Stevenson, and found that it agreed in all details with the original diagnosis. The characters were found to be sufficiently distinct to warrant the maintenance of *U. Kellermanii* as a distinct species: it does not form galls (Plate IV) and the chlamydospores are darker and have more pronounced echinulations. Although the maintenance of the species as distinct is tentatively accepted, there is undoubtedly a need for experimental studies with cross inoculations before a final disposition should be made.

SPECIES OF USTILAGO ON POLYGONUM AND RUMEX

Among the species of smuts that occur on *Polygonum* and *Rumex* spp., the author has found that *U. anomala*, *U. Parlatorei*, and *U. Bistortarum* have an unexpected degree of synonymy which, on the basis of preliminary studies, are indicated below.

1. **Ustilago anomala** Kunze, Fungi Exsiccati No. 23. 1875.
   Ustilago persicariae Ciferri, Ann. Mycol. **29**: 41. 1931.
   Ustilago muricata Liro, Ann. Acad. Sci. Fenn. Ser. A**17**: 238. 1924.

PLATE I, FIGS. F–J; TEXT FIG. I, A–C

Sori in the inflorescence. Chlamydospores yellow-hyaline to slightly brown or violet, globose to ovoid, 7–12 μ diam.; epispore reticulate, the reticulations polygonal and up to 2.6 μ diam.

HOSTS: *Polygonum dumetorum* L., *P. Persicaria* L., *P. Hydropiper* L. and *P. Convolvulus* L.

SPECIMENS EXAMINED: **Germany**: Saxony, on *Polygonum dumetorum*, August 1875, *J. Kunze in* Kunze: Fungi Sel. Exsic. No. 23, **type** of *U. anomala* (FH).—Rheinprovinz, Petersberg near Trier, on *P. Convolvulus*, 12 Oct. 1925, *C. Fahrendorff in* Zillig: Ustilag. Europ. No. 52a (FH).—Brandenburg Grossmantel, Aug. 1924, *C. Fahrendorff in* Zillig: Ustilag. Europ. No. 52b (FH).—Mellensee, Kr. Teltow, 20 July 1925, *C. Fahrendorff in* Zillig: Ustilag. Europ. No. 52c (FH).—Berlin, Silmargendorf, on *P. Convolvulus*, 2 Sept. 1891, *P. Hennings in* Sydow: Ustilagineen No. 1 (FH).—

Silmargendorf, on *P. Convolvulus*, Aug. 1886, *P. Sydow in* Sydow: Mycotheca Marchica No. 4112 (FH). — Bavaria, Stopelfelder, Höchberger Wald near Würzburg, 11 Sept. 1924, *H. Zillig in* Zillig: Ustilag. Europ. No. 33, **type** of *U. persicariae* (FH). — Nanhof near Ludkenwalde, on *P. Persicaria*, Aug. 1896, *P. Sydow in* Sydow: Ustilagineen No. 119 (FH). — **France:** Lorraine, Kelschberg near Forbach, on *P. Convolvulus* 13 Aug. 1913 and 8 Oct. 1902, *A. Ludwig in* Sydow: Mycotheca German. No. 1222 (FH). — **Czechoslovakia**: Moravia near Adamsthal, on *P. Convolvulus*, September, *G. v. Niessel in* Rabenhorst-Winter: Fungi Europ. No. 3102 (FH). — Bohemia, Tabor near Luznice River, on *P. dumetorum*, 9 Oct. 1905, *Fr. Bubak in* Sydow: Ustilagineen No. 376 (FH). — **Hungary**: Nagybaracska, on *P. Hydropiper*, 25 Sept. 1925, *F. Greinich in* Zillig: Ustilag. Europ. No. 94 as *U. Cordai* Liro (FH). — Komitat Bacs, on *P. mite*, 21 Sept. 1925, *F. Greinich in* Zillig: Ustilag. Europ. No. 68 as *U. muricata* Liro (FH). — **Poland**: Warsaw, Bielany, on *P. dumetorum*, *Kochman in* Kochman: Ustilag. Polonia No. 16 (FH). — Krukienice Distr., Mosciska, on *P. Convolvulus*, 3 Sept. 1937 *in* Kochman: Ustilag. Polonia No. 17 (FH). — **Sweden**: Stockholm, on *P. Convolvulus*, Aug. 1884, *J. Eriksson in* Eriksson: Fungi Parasit. Scandinav. Exsic. No. 155 (FH). — **United States**: **Connecticut**, Montowese, on *P. dumetorum*, 14 Sept. 1903, *G. P. Clinton in* Seymour & Earle: Econ. Fungi Supplem. C, No. C134.

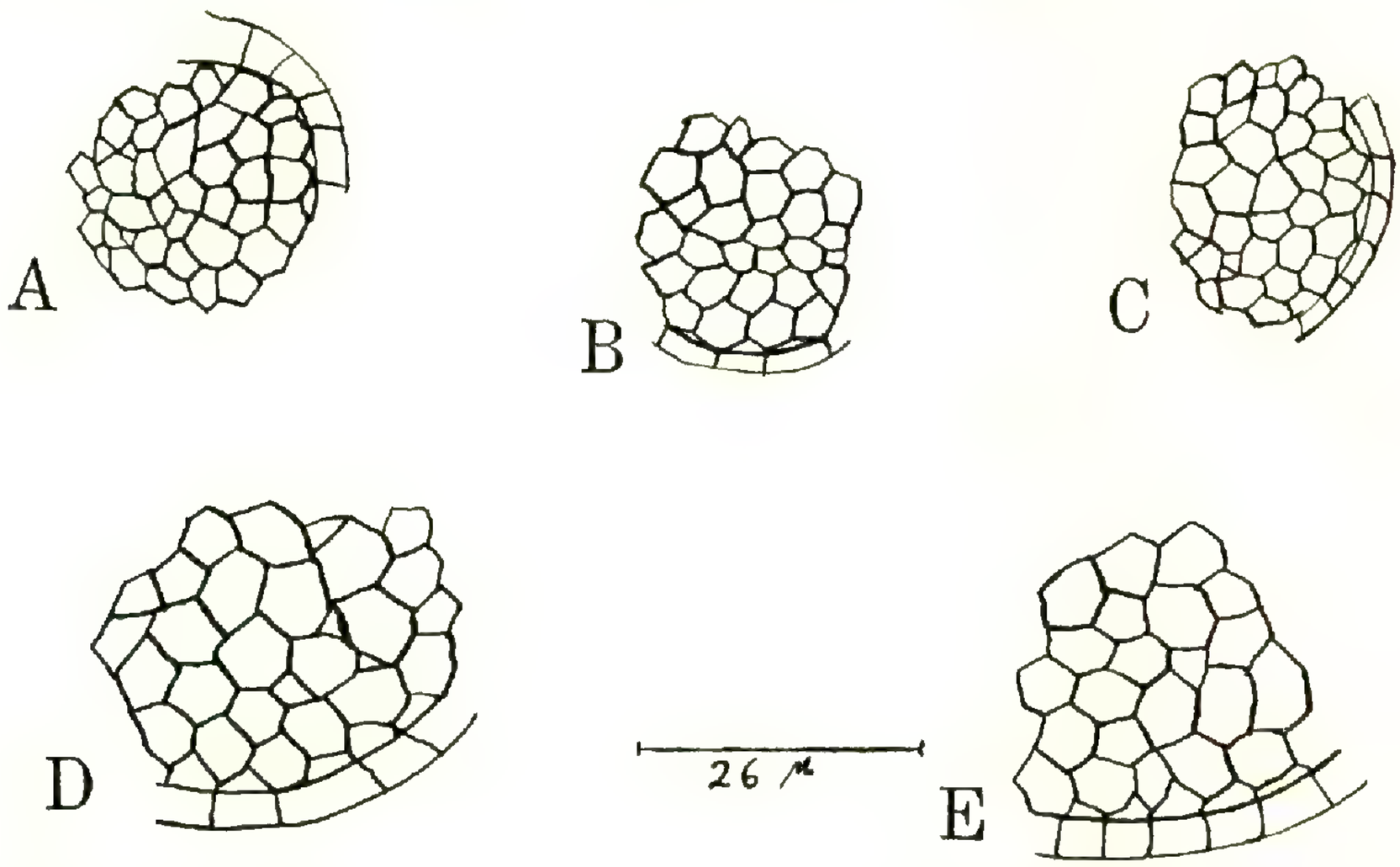
Ustilago anomala Kunze, *U. persicariae* Ciferri, *U. muricata* Liro, *U. carnea* Liro, and *U. Cordai* Liro attack *Polygonum dumetorum*, *P. Persicaria*, *P. mite* and *P. Hydropiper* respectively, and all of these fungi form their chlamydospores in the ovaries, the chlamydospores all possessing reticulate epispores. The descriptions of the species were based almost entirely on slight variations in color, diameter, reticulation of the epispore, and host specialization. A careful study of type or authentic material of these species demonstrates that there is a very great similarity between the species, especially between *U. anomala*, *U. persicariae* and *U. muricata*, as is shown in Table I.

TABLE I. CHLAMYDOSPORIC CHARACTERS OF U. ANOMALA, U. PERSICARIAE, U. MURICATA, U. CARNEA, AND U. CORDAI

SPECIES	COLOR	FORM	DIAMETER	EPISPORE
U. anomala	yellow-hyaline, slightly darker at epispore	globose-ovoid	7–13 μ	deeply reticulate; reticulation 1.9–2.6 μ 0.6–1 μ deep.
U. persicariae	as above	as above	9–12 μ	as above
U. muricata	yellow-hyaline, few pale violet	as above	7–12 μ	as above
U. carnea	hyaline	as above	7–12 μ	deeply reticulate, reticulations 4–6 μ in diameter
U. Cordai	yellowish to pale brown	as above	7–12 μ	as above

Comparing the characters given in Table I, it appears that the five species are very closely related and that the differences between the first three species consist only in a slight variation in color and size (1–2 μ) of

the chlamydospores. Considering that these three species grew on different host species, it is absurd to designate them as different species or even as different morphological varieties. Since host specialization does not affect their morphology, it is proposed to make *U. persicariae* and *U. muricata* synonymous with *U. anomala*. The second group of species, *U. carnea* and *U. Cordai*, as shown in Table I form a group that is characterized by the markedly larger size of the reticulations of the epispore. As a rule, the color of the chlamydospores of *U. Cordai* is darker than that of *U. anomala*, whereas those of *U. carnea* are the same color or else some-



TEXT FIG. I. Camera lucida drawings to show the reticulations characteristic of **A.** *Ustilago anomala*, from type material. **B.** *Ustilago persicariae*, from type material. **C.** *Ustilago muricata*, from type material. **D.** *Ustilago carnea*, from type material. **E.** *Ustilago carnea*, from authentic material.

what lighter. The color of the chlamydospores is a character that varies considerably with environmental conditions and is somewhat dependent upon host relations. In view of the fact that the size of the reticulations is the only consistent character that can be used to segregate the species *U. carnea* and *U. Cordai* from the remainder of the complex, it seems desirable to recognize *U. carnea* as a variety of *U. anomala* and to make *U. Cordai* a synonym of this variety. The new combination is proposed below.

Ustilago anomala var. **carnea** (Liro) Hirschhorn n. comb.

Ustilago carnea Liro, Ann. Soc. Zool. Bot. Fenn. Vanamo **1**: 27. 1923.
Ustilago Cordai Liro, Ann. Acad. Sci. Fenn. Ser. A **17**: 12. 1924.

TEXT FIG. I, D–E

Sori in the inflorescences. Chlamydospores deep yellow to brown, 7–12 μ diam., globose or ovoid; epispore deeply reticulate, the reticulations 5–6 μ in diameter.

HOSTS: *Polygonum Convolvulus* L. and *P. Hydropiper* L.

Liro differentiated these species on the basis of their host specialization, but if such a criterion were to be followed consistently for all parasitic fungi, *Puccinia graminis* could, on the same basis, be split into a hundred or more species when one considers the physiologic races which have the capacity to attack certain host plants and not others.

2. **Ustilago Bistortarum** (De Candolle) Koernicke, Hedwigia **16**: 38. 1877.

Ustilago inflorescentiae Trelease, Harriman Alaska Exped., Crypt. Bot. Alaska **V**: 35. 1904.

Attacks leaves and flowers. Chlamydospores yellowish to brown-violet, globose or irregularly elongate, 10–16 μ diam. or 7–12 x 14–18 μ; epispore uniformly verrucose.

HOSTS: *Polygonum Bistorta* L. and *P. viviparum* L.

SPECIMENS EXAMINED: **Norway**: Tromsö, on *P. viviparum*, June 1895, *Lagerheim in* Sydow: Ustilagineen No. 3 (FH). — **Sweden**: Jemtland, on *P. viviparum*, 1 July 1930, *D. A. G. Eliasson in* Zillig: Ustilag. Europ. No. 117 as *U. ustilaginea* (DC) Liro (FH). — Jemtland, Hålland, on *P. viviparum*, July 1890, *in* T. Vestergren: Micromyc. Rar. Sel. No. 580 (FH). — Stockholm, on *P. viviparum*, 24 June 1891, *L. Romell in* Romell: Fungi Exsic. Praes. Scandinav. No. 134 as *Sphacelotheca hydropiperis* (Schum.) DeBy. (FH). — **Germany**: Bavaria, Oberammergau, on *P. Bistorta*, May 1901, *B. Kaufman in* Sydow: Ustilagineen No. 190 (FH). — **Switzerland**: St. Moritz, on *P. viviparum in* Fuckel: Fungi Rhen. No. 2618 as *Ustilago Candollei* Tul. (FH). — **Czechoslovakia**: Bohemia, Toschow near Levin, on *P. Bistorta*, 31 May 1901 *in* Sydow: Ustilagineen No. 190 (FH). — **Russia**: Moscow, May 1893, *Sydow in* Sydow: Ustilagineen No. 3 (FH). — **United States**: **Wyoming**: Big Horn Mts., on *P. viviparum*, Aug. 1898, *Williams & Griffiths in* Griffiths: West Amer. Fungi No. 223 as *Sphacelotheca Hydropiperis* (FH). — **Colorado**: Seven Lakes, on *P. viviparum*, *in* Clements: Cryptog. Form. Colorado. No. 154 as *U. Bistortarum* var. *inflorescentiae* Trel. (FH).

Ustilago Bistortarum and *U. inflorescentiae* develop on the leaves and flowers of *P. Bistorta* and *P. viviparum* respectively. Observations on type or authentic material of these species revealed that they possess the same microscopic characters and that the only difference between the two species is their localization in certain organs of the host, — *U. Bistortarum* on the leaves and *U. inflorescentiae* on the flowers. In both species, the chlamydospores are brown-violet with a yellowish shade, globose or irregularly elongate 10–16 μ in diameter or 7–12 x 14–18 μ with the epispore 0.65–1.0 μ thick and uniformly verrucose. Both forms produce a three-celled basidium. These observations coincide with those of Linder (4) who studied the type of *U. inflorescentiae* and in referring to the ornamentation of the spores concludes ". . . the spores [of *U. inflorescentiae*] are just as pronouncedly ornamented as the specimens here placed in the species, and also are ornamented to the same degree as are the spores of *U. Bistortarum*."

Not considering localization of infection in an organ as a character sufficient to differentiate species, the writer proposes to place *U. inflorescentiae* in synonymy under *U. Bistortarum*.

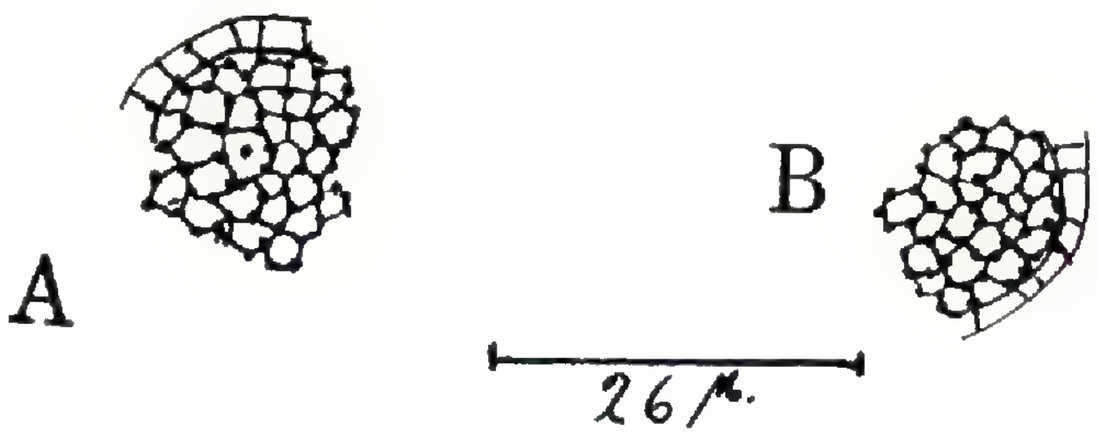
3. **Ustilago Parlatorei** Fischer v. Waldheim, Hedwigia **15**: 177. 1877.
Ustilago stygia Liro, Ann. Acad. Sci. Fenn. Ser. A **17**: 25. 1924.

PLATE I, FIGS. A-B; TEXT FIG. II, A-B

Attacks various parts of the host. Chlamydospores brown-violet to slightly yellowish, globose or irregular, 10–15 μ diam.; epispore deeply and irregularly reticulate with column-like structures which project at the angles of the reticulations.

HOSTS: *Rumex maritimus* L., *R. Acetosella* L., *R. Acetosa* L., *R. alpinus* L. and *R. britannicus* auct.

SPECIMENS EXAMINED: **Germany**: Hessen Nassau, Marburg, on *R. Acetosa*, 10 May 1926, *P. Claussen in* Zillig: Ustilag. Europ. No. 96 as *U. stygia* (FH). — **Switzerland**: Canton Uri, Meienthal, on *R. alpinus*, 27 Aug. 1907, *E. Fischer in* Sydow: Ustilagineen No. 405 (FH). — **Czechoslovakia**: Bohemia, Lundenburg, on *R. maritimus*, 8 March 1924, *R. Picbauer in* F. Petrak: Flora Bohem. et Morav Exs. Ser. H, Abt. 1, Lfg. 40, No. 1990 (FH). — **Russia**: Stepankowa, 25 km N.W. of Moscow, on *R. maritimus*, Sept. 1876, *Fischer v. Waldheim in* Rabenhorst: Fungi Europ. No. 2291, **type** of *U. Parlatorei* (FH). — **United States**: **Missouri**: Saline Co., Emma, on *R. britannicus*, 25 July 1894, *C. H. Demetrio in* Sydow: Ustilagineen No. 112 (FH). — Saline Co., Emma, on *R. britannicus*, *C. H. Demetrio in* Rabenhorst-Winter-Pazschke: Fungi Europ. No. 4009 (FH).



TEXT FIG. II. Camera lucida drawings to show the characteristics of (**A**) *Ustilago stygia* and (**B**) *Ustilago Parlatorei* from authentic and type material respectively.

Ustilago Parlatorei Fischer v. Waldheim and *U. stygia* Liro inhabit the same organs of the host plant and differ only to a minor degree in microscopic details. *U. Parlatorei* is briefly characterized as follows: chlamydospores brown to brown-violet or yellow (Maerz & Paul, Sudan brown to Argus, Pl. 14L to Pl. 17A12), globose or irregular, 10–14 μ diam., and with the epispore reticulate with column-like structures at the angles of the reticulation. *Ustilago stygia* differs from this only in that there is a slight variation in color and that the spores are 13–15 μ in diameter, the reticulations being somewhat larger. The slight differences do not justify keeping these species separate and it is therefore proposed to reduce *U. stygia* to synonymy under *U. Parlatorei*.

Ustilago Kuhneana Wolff on *Rumex Acetosella* is very similar to *U. Parlatorei* but its larger chlamydospores are more regularly reticulated and it does not form column-like structures at the junctions of the reticulations. Also, the larger wings of the reticulations at the margins make it advisable to keep the species separate until experimental studies can be made

to determine the validity of these characters as well as the range of variation.

SPECIES OF CINTRACTIA ON CAREX SPP. AND RHYNCHOSPORA SPP.

As in the case of the smuts on *Polygonum*, there are smuts which occur on *Rhynchospora* spp. and *Carex* spp. that have a great number of synonyms, some of which are reported below.

1. **Cintractia limosa** Sydow, Ann. Mycol. **22**: 288. 1924.
Cintractia turfosa Sydow, Ann. Mycol. **22**: 289. 1924.

PLATE II, FIGS. F-G

Attacks the inflorescence. Chlamydospores brownish black to castaneous, globose or irregularly elongate, 19–24 μ diam. or 20–24 x 13–14 μ; 0.65–1.5 μ thick, granulate to almost smooth.

HOSTS: *Carex limosa* L. and *C. dioica* L.

SPECIMENS EXAMINED: **Norway**: Kaafjard, on *Carex dioica*, July 1895, *G. Lagerheim* as *C. Caricis in* Sydow: Ustilagineen No. 75 (FH).—Tromsö, on *Carex limosa*, Aug. 1894, *G. Lagerheim in* Sydow: Ustilagineen No. 76 (FH).—**Finland**: Lapponia, Peltovuoma, Peltojoki, on *Carex dioica*, 24 July 1933, *H. Roivainen & J. I. Liro in* Liro: Mycotheca Fenn. No. 31 as *Cintractia turfosa* (FH).—Alandia, Finstrom, Godby, on *Carex limosa*, 7 July 1919, *T. Putkonen in* Liro: Mycotheca Fenn. No. 29, as *Cintractia limosa* (FH).—Ostrobothnia, Turtola, Arajarvi, 21 July 1933, *H. Roivainen & J. I. Liro in* Liro: Mycotheca Fenn. No. 30 as *Cintractia limosa* (FH).—**Germany**: Berlin, on *Carex limosa*, Aug. 1887, *Sydow in* Sydow: Mycotheca Marchica No. 1514 as *Ustilago Caricis* (FH).—on *Carex limosa*, July 1895, *Sydow in* Sydow: Ustilagineen No. 77 (FH).—Paulsborn near Berlin, on *Carex limosa*, 28 July 1903, *Sydow in* Sydow: Mycotheca German. No. 219 as *Cintractia caricis* (FH).

From a comparison of type material of *Cintractia limosa* Sydow and *C. turfosa* Sydow which parasitize *Carex limosa* and *C. dioica* respectively, there appears to be a very close relationship between the two species. Both species have brown-blackish to castaneous and globose to irregularly elongate spores. They differ in that the chlamydospores of *C. limosa* measure 19–21 μ diam. or 20–22 x 14 μ with a granulate to almost smooth epispore that is 1.3 to 1.5 μ thick. The spores of *C. turfosa* measure 20–24 μ diam. or 20–24 x 13–14 μ and the epispore is 0.65 to 1.3 μ thick. It is obvious that only very slight differences exist between the two species and they are not sufficient to warrant segregating the species. A study of other specimens of these species showed that there are variations within the same species which are greater than those between the two species. Therefore it is proposed to reduce *Cintractia turfosa* to synonymy under *C. limosa* since the latter has priority by one page in the same article.

Cintractia limosa is very similar to *C. Caricis*, but lack of type material prevents a comparison that would enable the writer to draw definite conclusions.

2. **Cintractia utriculicola** (Henn.) Clint., Journ. Mycol. **8**: 143. 1902.
Cintractia Rhynchosporae Ciferri, Arkiv f. Botanik **23**(14): 9. 1931.

PLATE II, FIGS. A–B

Sori in the inflorescence, transforming the ovaries into a blackish chlamydosporic mass. Chlamydospores olivaceous-brown, lighter at the center, globose to slightly irregular, 11–16 μ diam., epispore 1.3–1.95 μ thick, smooth.

HOSTS: *Rhynchospora corymbosa* (L.) Britt. and *Rhynchospora* sp.

Cintractia utriculicola (Henn.) Clint., *C. Rhynchosporae* Cif. and *C. limitata* Clint. produce their sori in the inflorescence of *Rhynchospora corymbosa*, *Rhynchospora* sp. and *Cyperus lijurius* respectively. The chlamydospores of the three species are very similar, as is indicated in Table II.

TABLE II. MICROSCOPIC CHARACTERS OF C. UTRICULICOLA, C. RHYNCHOSPORAE, AND C. LIMITATA

SPECIES	COLOR	FORM	DIAMETER	EPISPORE
C. utriculicola	brown olivaceous (Partridge to umber)	globose to irregular	13–16 μ	smooth, 1.3–1.95 μ thick
C. Rhynchosporae	as above	as above	11–16 μ	as above
C. limitata	as above but slightly darker at epispore	as above	10–13 μ	smooth, 0.65–1.3 μ thick

It is evident that *C. utriculicola* and *C. Rhynchosporae* are the same morphologic species. The only difference is that the fungous membrane which covers the sorus of *C. Rhynchosporae* is thinner, a difference which does not in itself furnish a character stable enough to use in differentiating species since it varies with the host. It is therefore proposed to place *C. Rhynchosporae* in synonymy under *C. utriculicola*.

C. Rhynchosporae was reduced by Zundel to synonymy with *C. Montagnei* but the echinulations of the chlamydospores of this latter species marks it as distinct.

C. limitata produces chlamydospores which are slightly darker, slightly smaller and with thinner epispores than those of *C. utriculicola*. The sori are restricted to the glumes. Such differences should not be considered as more than varietal and for this reason the writer proposes the following new combination.

3. **Cintractia utriculicola** (Henn.) Clint. var. **limitata** (Clint.) Hirsch. comb. nov.
Cintractia limitata Clint. Proc. Boston Soc. Nat. Hist. **31**: 399. 1904.

PLATE II, FIG. C

4. **Cintractia Montagnei** (Tul.) Magnus, Abhandl. Bot. Ver. Prov. Brandenb. **37**: 79. 1896.

Cintractia gigantospora Liro, Ann. Acad. Sci. Fenn. Ser. A **42**: 47. 1935–38.

Cintractia Montagnei (Tul.) Magnus and *C. gigantospora* Liro both attack the ovaries of *Rhynchospora alba* and their macro- and microscopic characters are alike, according to studies based on type and authentic material. Liro (*op. cit.*) includes *C. Montagnei* as a synonym of *C. gigantospora* but according to the rules of priority it is the latter that should fall into synonymy.

HOST: *Rhynchospora alba* Vahl.

SPECIMENS STUDIED: **Finland**: Alandia, Finström, Storträsk, on *Rhynchospora alba*, 26 July 1897, *A. S. Kajava & J. I. Liro in* Liro: Mycotheca Fenn. No. 26, **type** of *Cintractia gigantospora* (FH).—**Germany**: Siegsburg, on *Rhynchospora alba*, 1873, *Körnicke in* Thuemen: Mycotheca Univ. No. 929 (FH).

5. **Cintractia microsora** Sydow, Ann. Mycol. **22**: 289. 1924.

Cintractia aspera Liro, Ann. Acad. Sci. Fenn. Ser. A **42**: 18. 1938.

Attacks the inflorescence. Chlamydospores olivaceous black, subglobose or irregularly elongate, 17–22 μ diam. or 7–19 x 19–22 μ; epispore granulate and 1.3–2.6 μ thick.

HOSTS: *Carex chordorrhiza* L. and *C. remota* L.

SPECIMENS EXAMINED: **Finland**: Kittilä, Sirkankylä, on *Carex chordorrhiza*, 28 July, 1933, *Roivainen & Liro in* Liro: Mycotheca Fenn. No. 41, **type** of *Cintractia aspera* (FH).—**Japan**: Musashi Prov., Takao, on *Carex remota*, 8 May 1899, *S. Kusano in* Sydow: Ustilagineen No. 223, **type** of *Cintractia microsora* (FH).

Cintractia aspera and *C. microsora* are parasitic in the inflorescence of *Carex chordorrhiza* and *Carex remota* respectively. The color and shape of the chlamydospores of the two species and the granulate epispore are alike in both species. The chlamydospores differ only in size, those of *C. microsora* being 19–22 μ diam. or 11–19 x 19–22 μ and those of *C. aspera* 17–22 μ diam. or 7–16 x 19–22 μ. The epispores of *C. microsora* measure 1.3–2.6 μ thick and those of *C. aspera* 1.95–2.6 μ. Thus the difference between the two species is very slight. Furthermore, the fact that there are a greater number of roundish spores, and that there is less pronounced ornamentation, and the epispore of *C. aspera* is thinner, does not warrant the segregation of the two species even though they parasitize different host species. For this reason, *C. aspera* is reduced to synonymy under *C. microsora*.

6. **Cintractia arenaria** Sydow, Ann. Mycol. **22**: 289. 1924.

Ustilago Caricis var. *leioderma* Lagerheim, Mitt. Bad. Bot. Ver. No. 55–56: 37. 1888.

Cintractia lejoderma (Lagerheim) Ciferri, Ann. Mycol. **29**: 43–45. 1931.

PLATE II, FIGS. D–E

Sori in the inflorescence. Chlamydospores olivaceous brown, subglobose or irregularly polygonal, 16–18 μ diam. or 13–15 x 16–20 μ; epispore smooth.

HOSTS: *Carex brizoides* L., *C. arenaria* L. and *C. leporina* L.

SPECIMENS EXAMINED: **Germany**: Pomerania, Kreis Usedom-Wollin near Misdroy, on *Carex arenaria*, 29 Aug. 1923, *M. Noack in* Zillig: Ustilag. Europ. No. 2 as *Cintractia Caricis* (FH). — Pomerania, Rügenwaldermünde, on *Carex arenaria*, July 1893, *Sydow in* Sydow: Ustilagineen No. 14 as *Ustilago olivacea*, authentic material of *Cintractia arenaria* (FH). — Island of Sylt, Westerland, on *Carex arenaria*, 6 Aug. 1911, *Sydow in* Sydow: Ustilagineen No. 442, authentic material of *Cintractia arenaria* (FH). — **Hungary**: Pozsony, Bratislava [Presburg], on *Carex leporina*, July 1913, *A. Bäumler in* Zillig: Ustilag. Europ. No. 74 as *Cintractia Caricis* (FH). — **Czechoslovakia**: Moravia, Doubrava near Schwarzbach, on *Carex brizoides*, 17 July 1897, *Fr. Bubák in* Sydow: Ustilagineen No. 178, **type** of *Cintractia leioderma* (FH). — Ribar near Weisskirchen, on *Carex brizoides*, 28 June 1926, *F. Petrak in* Zillig: Ustilag. Europ. No. 71 as *Cintractia Caricis* (FH).

Studies of type and authentic material of *Cintractia leioderma* and *C. arenaria* leave little doubt that they are the same species. Both species produce their sori in the ovaries, and nearly all their microscopical characters are the same. The only difference is that in *C. leioderma* the spores measure 16–18 μ diam. or 13–15 x 19–22 μ whereas those of *C. arenaria* measure 15–17 μ diam. or 11–13 x 16–20 μ. The fact that these two species developed on different hosts without change of microscopic characters, except for differences in size, would indicate that they are the same species, and therefore the writer proposes to consolidate the species and retain *Cintractia arenaria* Sydow as the valid name.

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LA PLATA, ARGENTINA

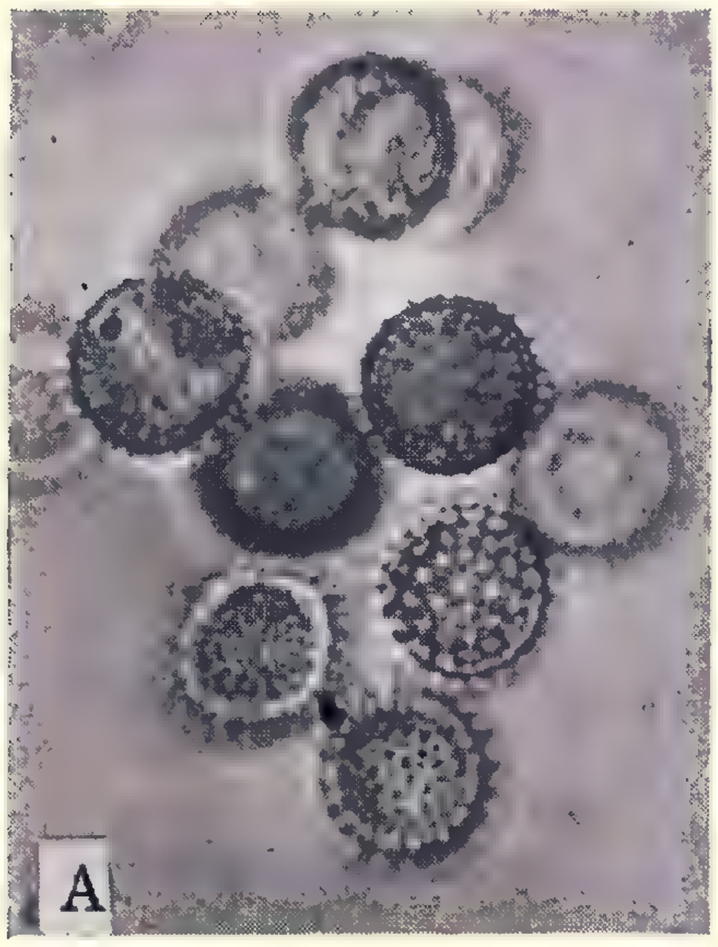
LITERATURE CITED

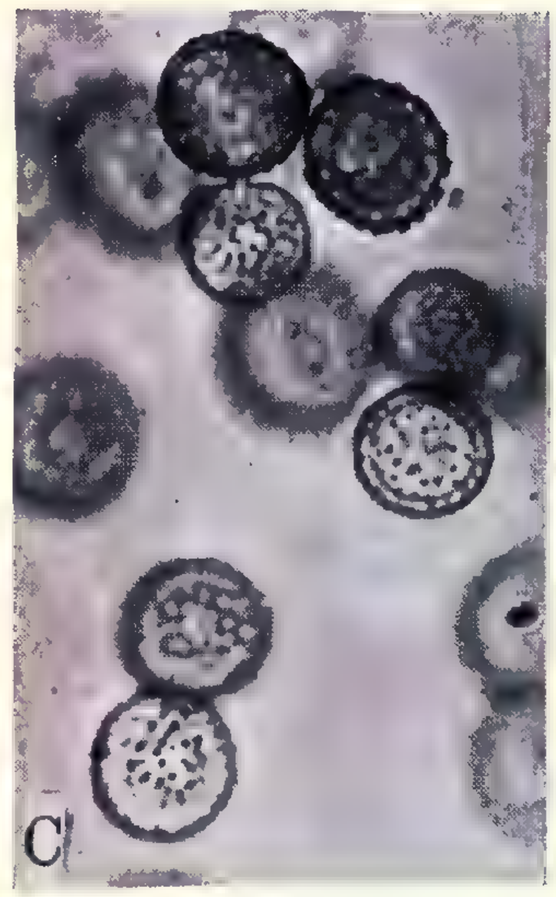
1. **Ciferri, R.** Smuts collected in Santo Domingo. Arkiv f. Botanik **23**A(14): 1–29. 1931.
2. **Clinton, G. P.** Ustilaginales. North American Flora **7**(1): 15. 1906.
3. **Fischer, G. W. & Elisa Hirschhorn.** A critical study of some species of Ustilago causing stem smut on various grasses. Mycologia **36**: 236–266. 1945.
4. **Linder, D. H.** *in* Polunin, N. Botany of the Canadian Eastern Arctic. Part II (in press).
5. **Passerini, G.** *in* Anzi, M. *et al.* Erbario Crittogamico Italiano Ser. II, fasc. 23/24, No. 1125. 1882.
6. **Maerz, A. & M. R. Paul.** A Dictionary of Color. McGraw-Hill. 1930.
7. **Spegazzini, C.** Mycetes argentinenses. Anal. Mus. Nac. Buenos Aires **3**(1): 59. 1902.

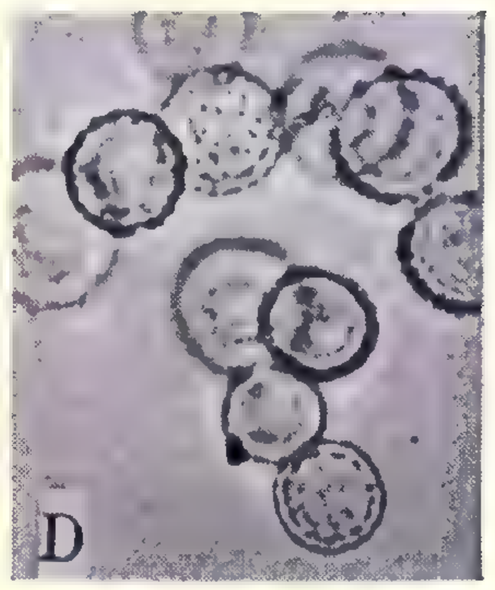
EXPLANATION OF PLATE I

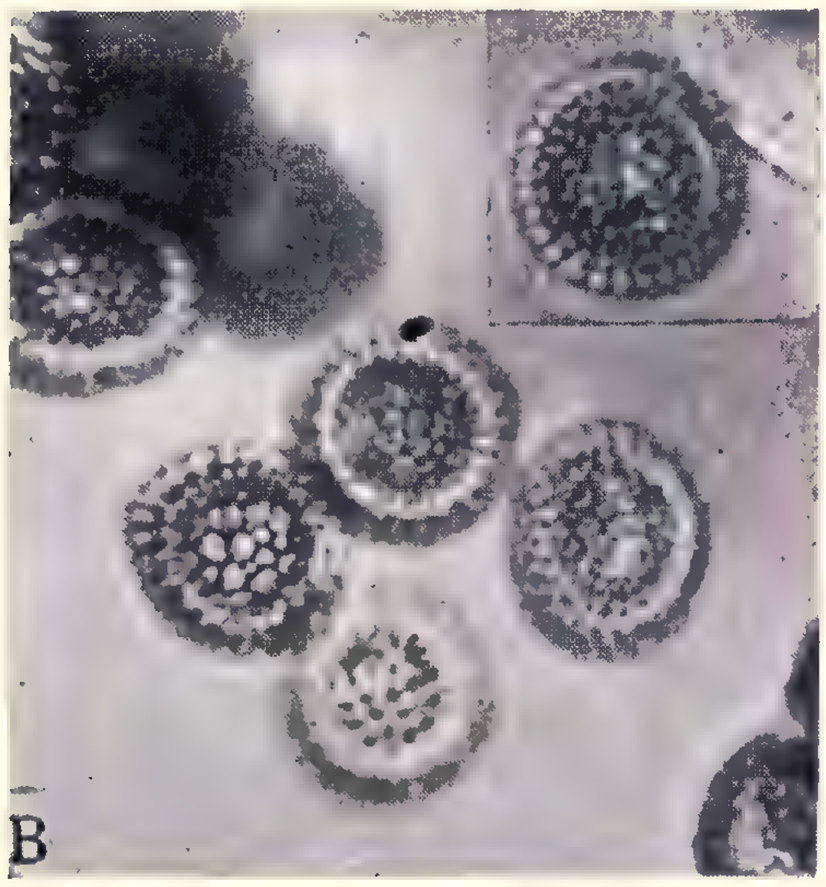
All photomicrographs were made at the same magnification.

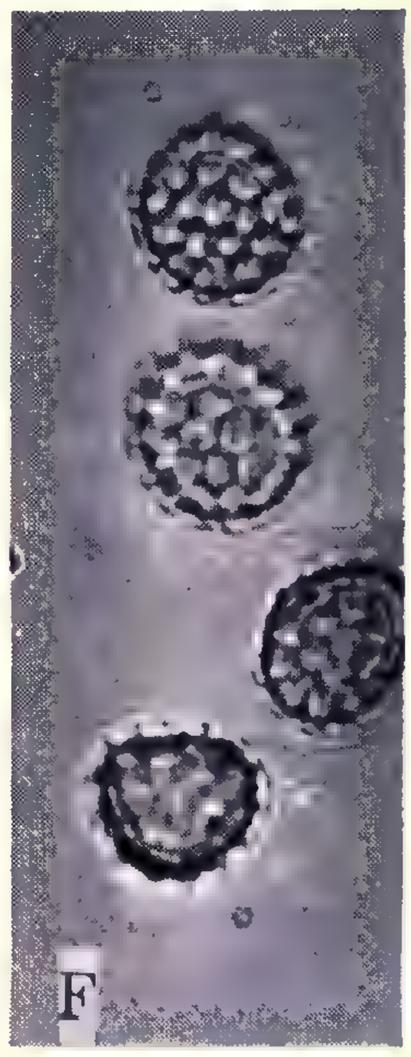
A. *Ustilago Parlatorei*, spores from type material.
B. *Ustilago stygia*, spores from authentic material.
C. *Ustilago Zeae*.
D. *Ustilago Euchlaenae*, spores from type material.
E. *Ustilago hypodytes*, spores from lectotype.
F. *Ustilago persicariae*, spores from type material.
G. *Ustilago anomala*, spores from type material.
H. *Ustilago Cordai*.
I. *Ustilago muricata*.
J. *Ustilago carnea*.

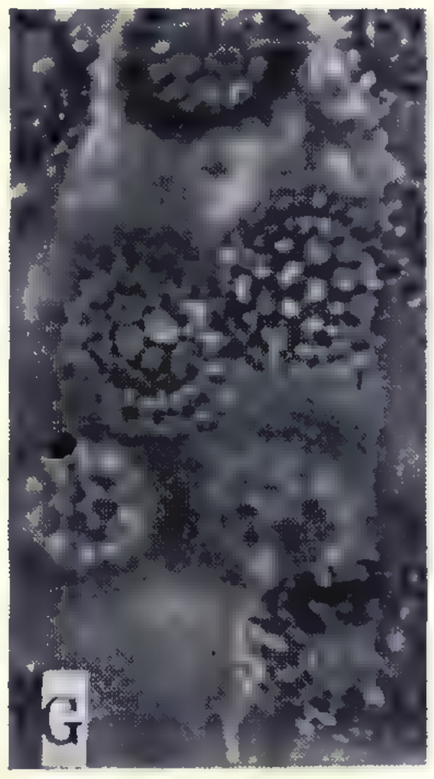


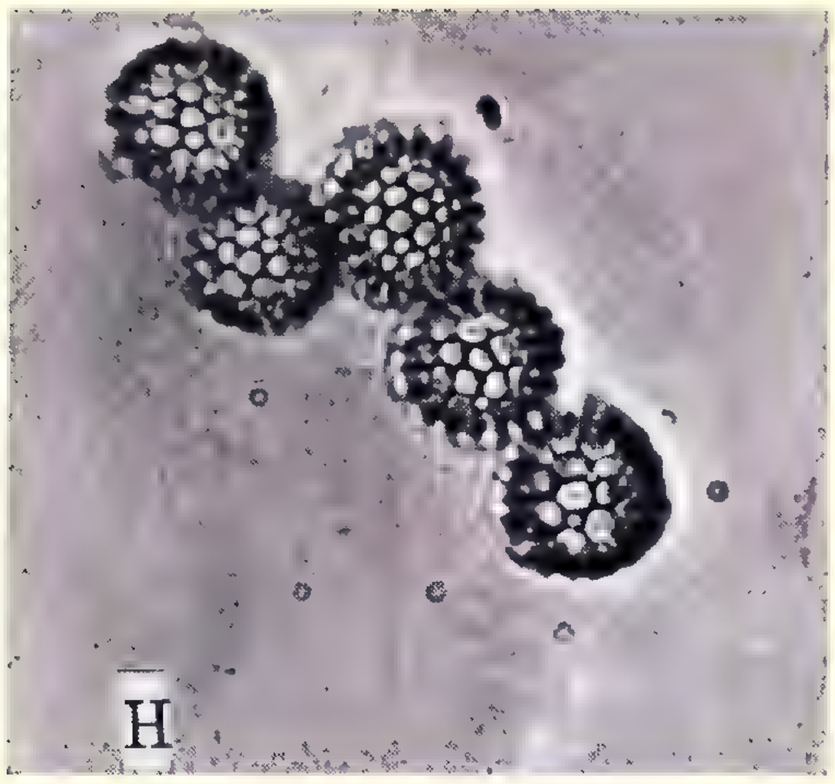


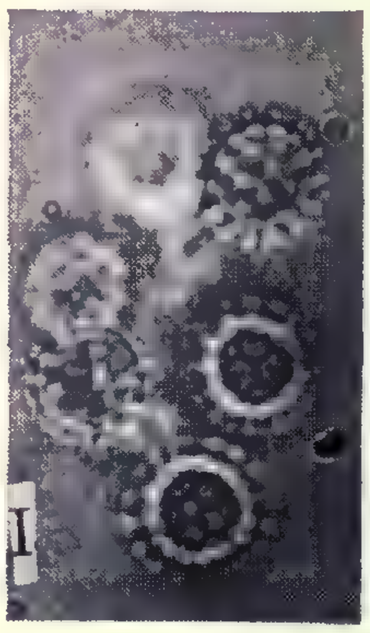












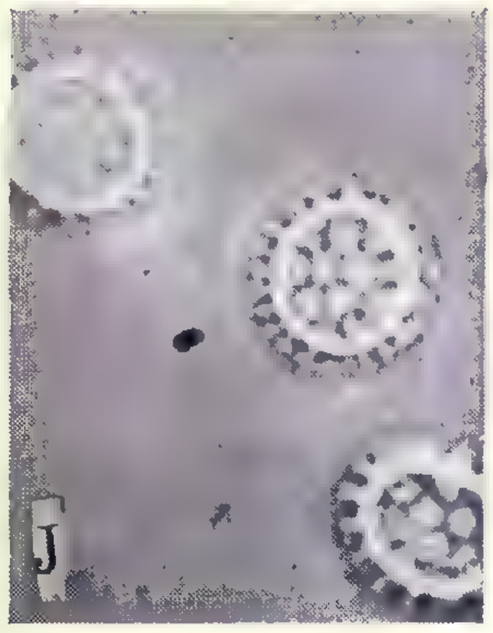
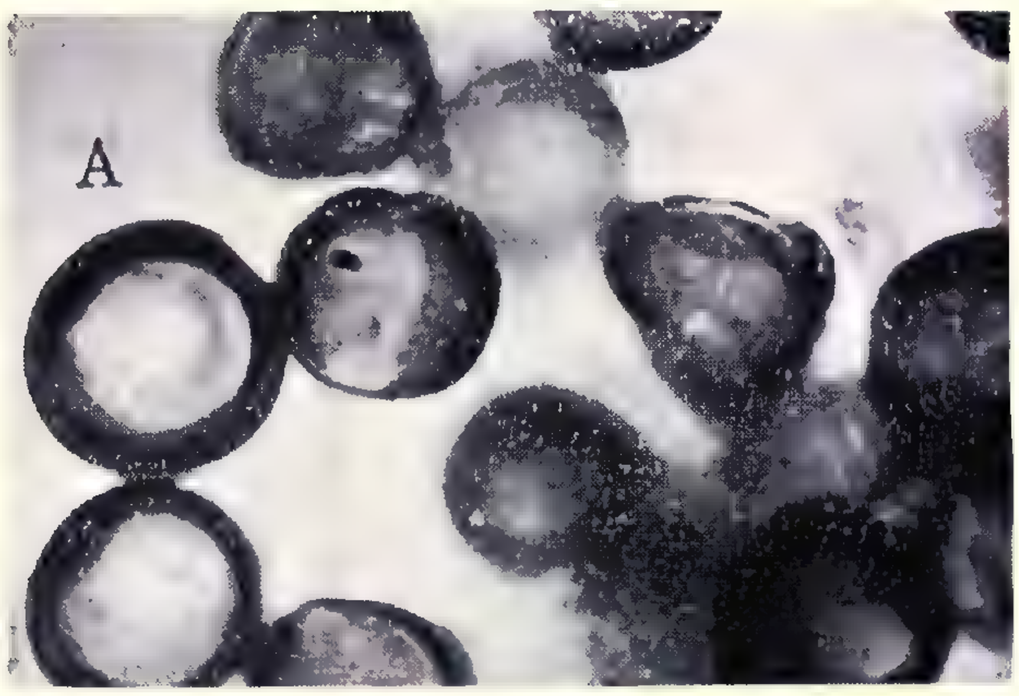


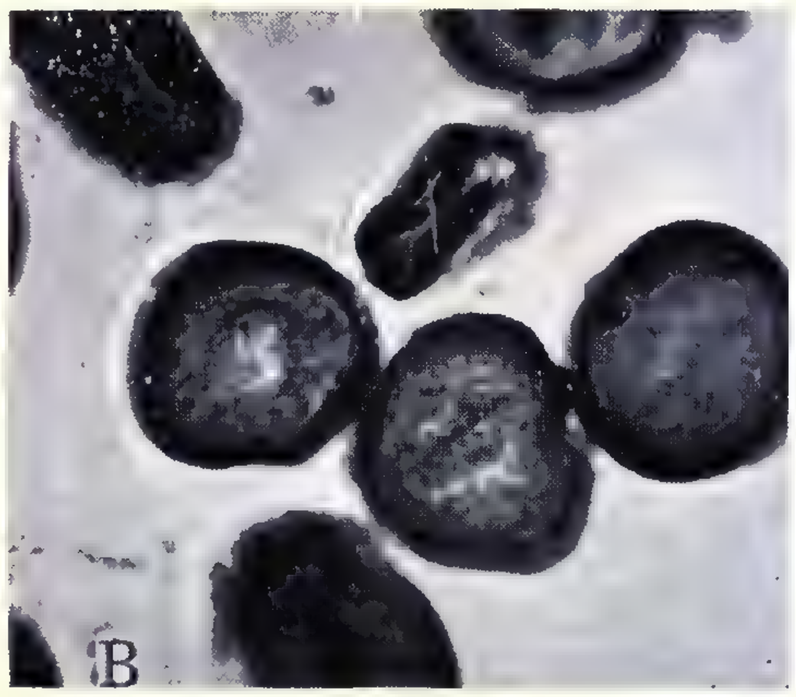
PLATE I

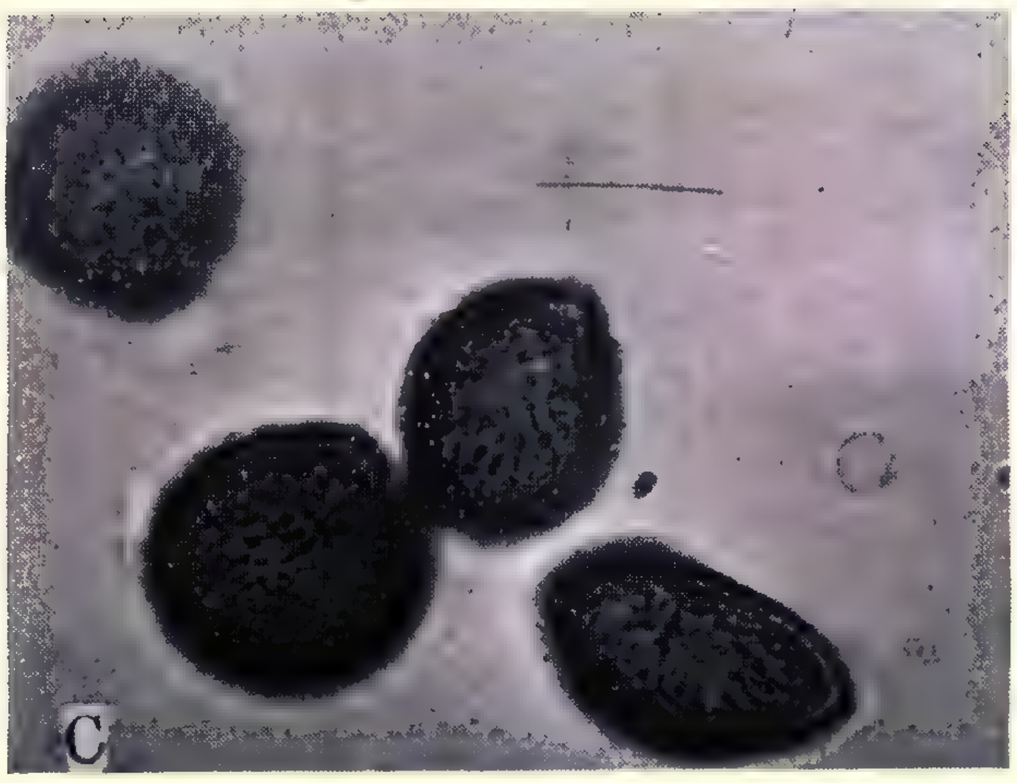
EXPLANATION OF PLATE II

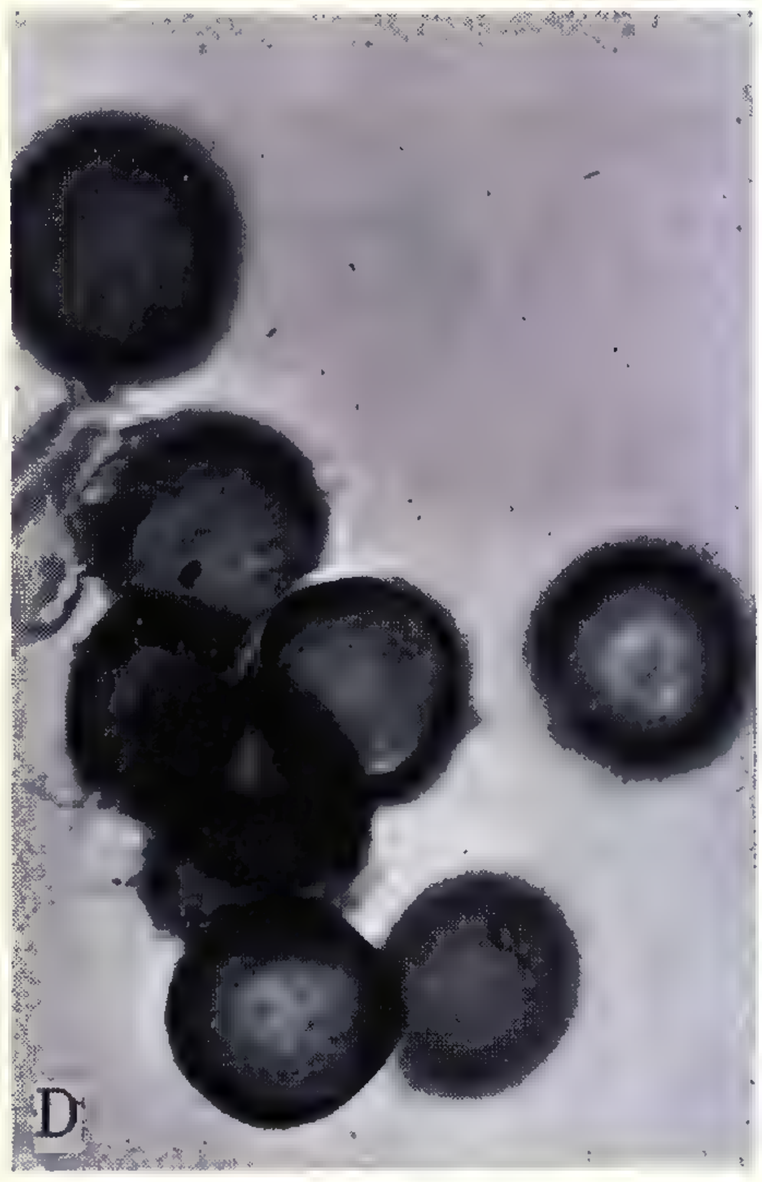
All photomicrographs were made at the same magnification.

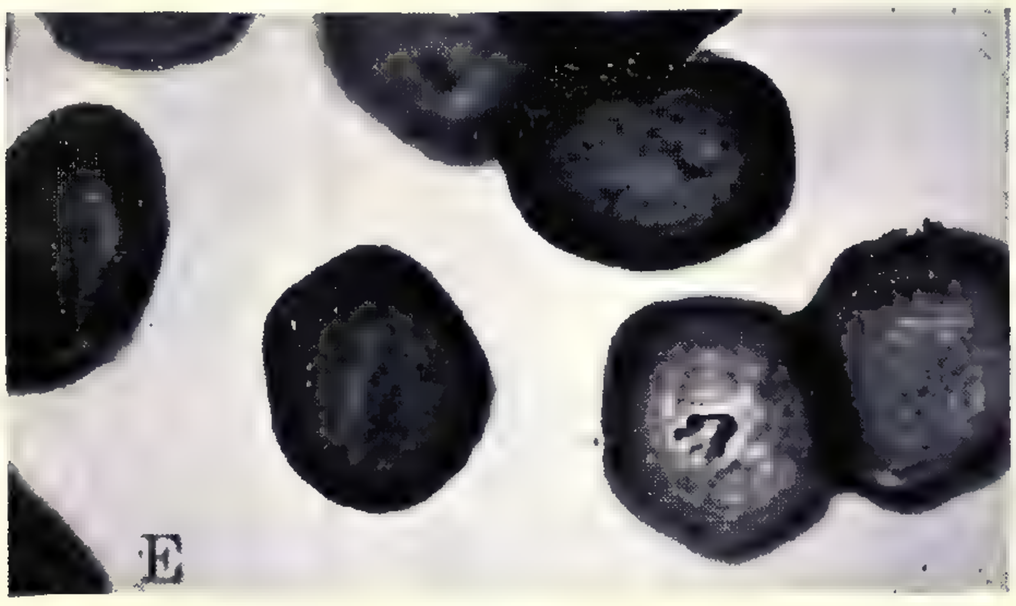
A. *Cintractia utriculicola*, spores from authentic material.
B. *Cintractia Rhynchosporae*, spores from type material.
C. *Cintractia utriculicola* var. *limitata*, spores from type material.
D. *Cintractia leioderma*, spores from type material.
E. *Cintractia arenaria*, spores from type material.
F. *Cintractia turfosa*, spores from type material.
G. *Cintractia limosa*, spores from type material.

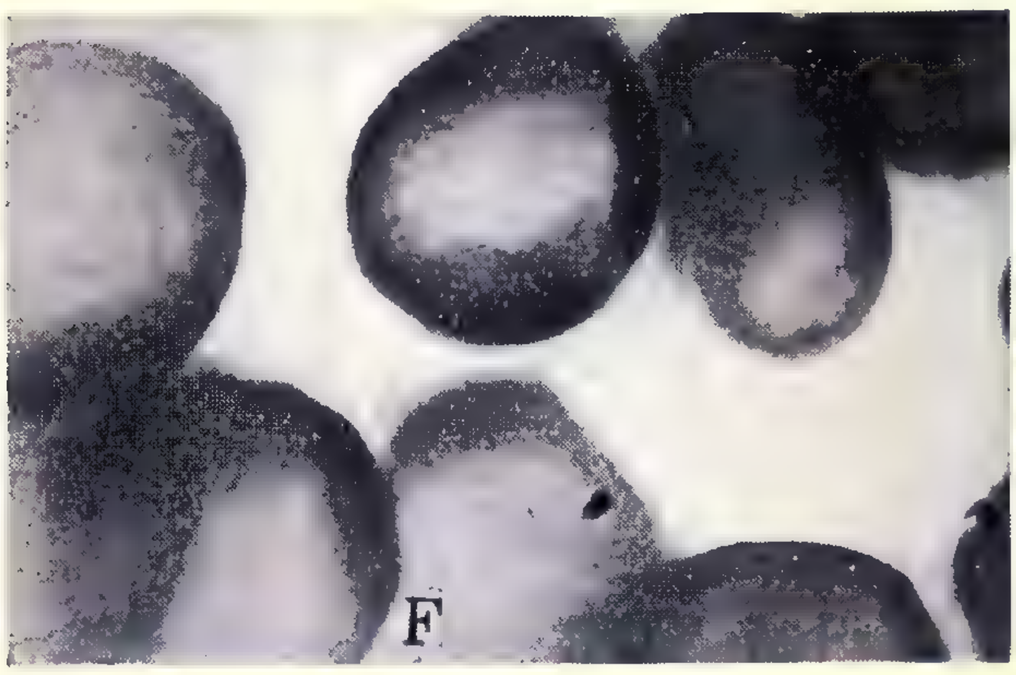












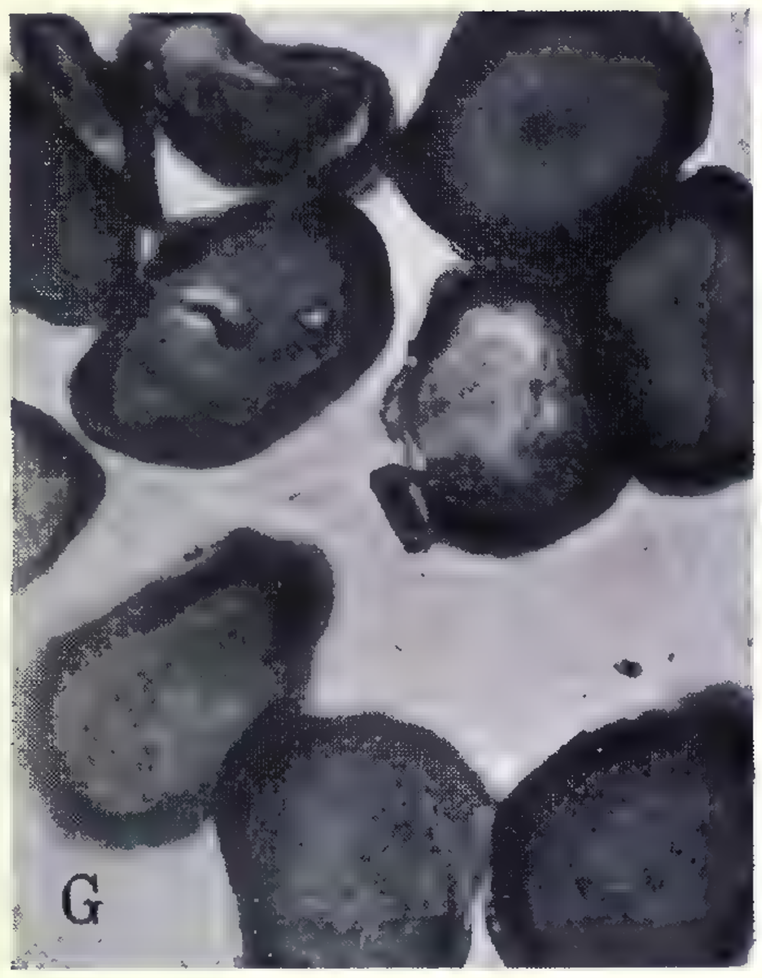


PLATE II

EXPLANATION OF PLATE III

Ustilago Euchlaenae, isotype specimen in Anzi *et al.*, Erb. Critt. Ital. Ser. II, No. 1152 (FH).

PLATE III

EXPLANATION OF PLATE IV

Ustilago Kellermanii on *Euchlaena mexicana* (Bureau Plant Industry 60395).

PLATE IV

3(1):95–139 FARLOWIA JANUARY, 1947

UREDINALES OF WESTERN CHINA [1]

F. L. TAI [2]

Little is known of the rusts of China, especially those of the western part. Delavay collected 13 species of rust fungi during his stay in Yunnan at the later part of the last century and 24 species were collected by Handel-Mazzetti in his collection trips in southwestern China during the first world war. This paper presents results of a study of rust collections made in the province of Yunnan. Included also are species from Szechuan, Hunan, Kweichow, Kansu and other provinces. Of the 213 species, which are distributed in 25 genera, and include 25 new species, 164 species are from Yunnan.

Because of the limitation of space, full data of the collections, except in the case of new species, are omitted. It should be mentioned that the collections of Yunnan were made by the writer and colleagues of this Division, also by Prof. L. T. Lin and Mr. T. H. Hung of the Sunyatsen University; those of Hunan by Messrs. C. C. Cheo and S. T. Chao; of Szechuan by Dr. L. Ling and his associates; and of Kansu by Mr. W. L. Hsian.

There is much confusion, as will be seen in the following pages, between certain species. It seems that many of the species, which have been described by European mycologists on poor and scanty material from Asia, need further study.

MELAMPSORACEAE

HYALOPSORA Magnus

Hyalopsora Polypodii (Diet.) Magnus

On *Dryopteris* sp. **Yunnan**: Shishan, Kunming, *4997*.[3]

MILESINA Magnus

Milesina erythrosora (Faull) Hiratsuka f.

On *Dryopteris* sp. **Yunnan**: Shishan, Kunming, *5686*.

PUCCINIASTRUM Otth

Pucciniastrum Agrimoniae (Diet.) Tranzsch.

On *Agrimonia zeylanica*. **Yunnan**: Hsiakwan, Tali, *4371*; **Hunan**: Hengshan, *4750*.

[1] Paper No. 26 from the Division of Plant Pathology, Institute of Agricultural Research, National Tsing Hua University, Kunming, Yunnan, China.

[2] The writer is indebted to Drs. W. Tranzschel, B. B. Mundkur, G. B. Cummins, H. Sydow, K. Boedijn, L. S. Berus, L. Ling, T. N. Liou, H. K. Chen, C. T. Wei, and Prof. L. T. Lin for sending specimens, and also to Mr. C. Y. Wu for determination of hosts and a number of collections.

[3] This refers to the Plant Pathology Herbarium number, Tsing Hua University.

Pucciniastrum Coriariae Diet.

On *Coriaria sinica*. **Szechuan**: Kwanhsien, *8406*, *8407*.

Pucciniastrum Castaneae Diet.

On *Castanea mollissima*. **Yunnan**: Kunming *5246*; **Szechuan**: Chengtu, *6821*. On *C. Henryi*. **Hunan**: Yolushan, Changsha, *4417*, *4512*, *4522*.

MELAMPSORIDIUM Klebahn

Melampsoridium Alni (Thuem.) Diet.

On *Alnus cremastogene*. **Szechuan**: Kwanhsien, *8405*.

CRONARTIUM Fries

Cronartium gentianeum Thuem.

On *Gentiana rigescens*. **Yunnan**: Changshan, Tali, *5070*; Chichushan, Pinchuan, *5069*.

Uredia hypophyllous, irregularly gregarious to scattered, roundish, bullate, at first covered by epidermis, then ruptured by an apical pore, 0.2–0.35 mm. in diameter, pale cinnamon brown; *uredospores* subglobose, ovate to ellipsoid, epispore 1.5–2 μ thick, subhyaline, sparsely and finely echinulate, 24–30 x 17–21 μ. *Telia* hypophyllous, gregarious, cylindrical, straight or slightly curved, pale cinnamon brown, 0.5–1.5 mm. long, 83–200 μ broad; *teliospores* oblong or cylindrical, obtuse at both ends, epispore yellowish, smooth, about 1 μ thick, 34–51 x 10–14 μ, germinating immediately; *sporidia* globose, 7.0–8.6 μ in diameter.

Cronartium Delavayi Pat. (Rev. Mycol. **8**:80. 1886) was described by Patouillard on collections from western Yunnan. Morphologically it is not distinct from *C. gentianeum* Thuem., and is here considered as a synonym of the latter.

Cronartium Quercuum Miyabe

On *Quercus acutissima*. **Yunnan**: Wenshan, *4434*; **Kweichow**: Meitan, *7935*.

Cronartium flaccidum (Alb. et Schw.) Winter

On *Delphinium Delavayi*. **Yunnan**: Changshan, Tali, *4621*; Chichushan, Pinchuan, *4332*.

Cronartium Keteleeriae sp. nov.

FIGURE 1

On *Keteleeria Elveyniana*. **Yunnan**: Shishan, Kunming, June 30, 1938, *C. C. Cheo & S. T. Chao*, *4638*, **type!**, *4429*, *4637*, *4639*.

Teliis hypophyllis, sparsis vel aggregatis, cylindraceis, plus minusve compressis, rectis vel parum curvatis, 2.5–6 mm. longis, 250–625 μ latis, "cadmium orange" (Ridgway); *teliosporis* fusiformibus vel oblongo-fusiformibus, utrinque acutis, levibus, hyalinis, 23–37 x 10–16 μ, *episporio* 1.5–2.5 μ crasso; *sporidiolis* globosis, 6–7 μ in diam.

CHRYSOMYXA Unger

Chrysomyxa Dietelii Syd.

On *Rhododendron trichocladum*. **Yunnan**: Changshan, Tali, *8161*.

Chrysomyxa Rhododendri De Bary

On *Rhododendron decorum*. **Yunnan**: Chichushan, Pinchuan, *8159*. On *R. Faberi*. **Szechuan**: Omeishan, *8424*.

PHAKOPSORA Dietel

Phakopsora Artemisiae Hiratsuka f.

On *Artemisia Dracunculus*. **Yunnan**: Kunming, *5051*. On *A. parviflora*. **Yunnan:** Kunming, *7962*. On *A. verbenacea*? **Yunnan**: Tapuchi, Kunming, *5074*.

Uredia amphigenous, mostly epiphyllous, gregarious in groups or scattered, roundish, 0.25–0.35 mm. in diameter, at first covered by epidermis, finally ruptured by a central pore or irregularly, pulverulent, cinnamon brown; *uredospores* globoid, ellipsoid or piriform, epispore 1.5–2 μ thick, echinulate, pale cinnamon brown or subhyaline, 24–39 x 16–26 μ; *pores* indistinct; *paraphyses* peripheral, straight or curved, clavate, hyaline, 41–64 x 6–10 μ.

Telia amphigenous, mainly hypophyllous, gregarious or scattered, minute, 0.1–0.2 mm. in diameter, often forming a ring around uredium, covered by epidermis, brownish-black or black; *teliospores* in 2–4 superposed layers, lentiform, oblong or broadly ovate, epispore cinnamon brown or paler below, chestnut brown at apex, 1–1.5 μ thick at sides, 3–7 μ thick at apex, 24–40 x 11–18 μ.

Phakopsora compositarum Miyake is stated by Hiratsuka to differ from *P. Artēmisiae* in the hypophyllous uredia, smaller uredospores and much longer teliospores. The former has been reported again from North China by Liou and Wang (Contr. Inst. Bot. Nat. Acad. Peiping **3**: 347–348. 1936) on *Artemisia*, *Chrysanthemum*, *Saussurea* and *Aster*. They found only the telial stage and gave the size of the teliospore as "25–50 x 10–19." The teliospores of the Yunnan plant are slightly longer than in *P. Artemisiae*, but shorter than *P. compositarum*. The measurements of the uredospores, however, accord well with those of *P. Artemisiae* which may prove to be identical with *P. compositarum*.

Phakopsora punctiformis (Barcl. et Diet.) Diet.

On *Galium asperifolium*. **Yunnan**: Tapuchi, Kunming, *8157*.

Phakopsora Ziziphi-vulgaris Diet.

On *Zizyphus sativa*. **Yunnan**: Hualing, *4821*. On *Paliurus* sp. **Szechuan**: Chengtu, *6840*.

Phakopsora Pachyrhizi Syd.

On *Pachyrhizus bulbosus*. **Yunnan**: I-Liang, *5149*. On *Glycine hispida*. **Yunnan**: Kunming, *4416*, *7655*; Hualing, *4873*; **Hunan**: Hengshan, *4661*. On *Pueraria Thunbergiana*. **Hunan**: Hengshan *4043*, *4044*.

Uromyces Sojae (P. Henn.) Syd. is synonymous with *U. Mucunae* Rabh. as has been pointed out by Butler and Bisby (Fungi of India p. 83. 1931); the host, erroneously identified as *Glycine Soja*, on which the combination, *U. Sojae* was made, proves to be *Mucuna* sp. and the fungus is *U. Mucunae* Rabh.

The uredospores of the Chinese forms are slightly larger, and the teliospores smaller than those given in the original diagnosis.

Phakopsora Ampelopsidis Diet. et Syd.

On *Vitis vinifera*. **Yunnan**: Lunan, *4367*; **Kansu**: Tienshui, *8422*. On *V. betulifolia*. **Szechuan**: Chengtu, *8430*.

Phakopsora hengshanensis sp. nov.

On *Ficus Martini*? **Hunan**: Hengshan, Nov. 18, 1937, *C. C. Cheo*, *4757*, **type!** On *F. heteromorpha*. **Hunan**: Hengshan, *4758*.

Urediis hypophyllis, sparsis vel subaggregatis, rotundatis vel irregularibus, 0.25–0.5 mm. latis, diu epidermide tectis, tandem poro centrali apertis, flavo-aurantiacis, paraphysibus numerosis, capitatis, 29–34 μ longis, 7–8.6 μ latis, hyalinis; *uredosporis* subglobosis vel ellipsoideis, subhyalinis, subtiliter verruculosis, 20–24 x 16–21 μ, episporio 1–1.5 μ crasso. *Teliis* hypophyllis, sparsis vel aggregatis, saepe confluentibus, laxe aut circulariter aggregatis, subepidermicis, rotundatis, 0.5–1 mm. diam., atro-brunneis; *teliosporis* 2–4 superpositis, cubicis, oblongis vel cylindraceis, 20–31 x 8.6–14 μ, episporio brunneolo, 1–1.5 μ crasso, ad apicem 2–3 μ crasso.

COLEOSPORIUM Lev.

ON ORCHIDACEAE

Coleosporium Arundinae Syd.

On *Spathoglottis pubescens*. **Yunnan**: Changshan, Tali, *5059*. On Orchidaceae. **Yunnan**: Changshan, Tali, *5060*.

The plants of these collections agree closely with *C. Arundinae* except that the uredospores are longer and slightly narrower (17–34–(40) x 14–23 μ) than those of the latter ("20–24 x 18–24 μ").

Coleosporium Bletiae Diet.

On Orchidaceae. **Yunnan**: Hsiakwan, Tali, *5061*. The uredospores of this form are slightly longer (21–31 x 15–20) than those of *C. Bletiae*. *C. Merrillii*, differing from the former only in the slightly shorter teliospores, may be synonymous.

ON RANUNCULACEAE

Coleosporium Aconiti Thuem.

On *Aconitum Vilmorinianum*. **Yunnan**: Chichushan, Pinchuan, *4618*.

Coleosporium Cimicifugatum Thuem.

On *Cimicifuga foetida*. **Yunnan**: Chichushan, Pinchuan, *4619*.

Coleosporium Clematidis Barcl.

On *Clematis Peterae*. **Yunnan**: Kunming, *4806*, *4839*, *6896*, *7808*. On *C. chrysocoma*. **Yunnan**: Kunming, *4769*. On *C. brevicaudata*. **Yunnan**: Kunming, *4846*. On *C. montana*. **Yunnan**: Hsiakwan, Tali, *4433*. On *C.* sp. **Yunnan**: Hsiakwan, Tali, *4542*; **Szechuan**: Omeishan, *6845*.

ON SAXIFRAGACEAE

Coleosporium Fauriae Syd.

On Saxifragaceae. **Yunnan**: Changshan, Tali, *5039*.

Uredia hypophyllous on angular yellow spots 2.5–5 mm. wide, circinately arranged, roundish, naked, surrounded by ruptured epidermis, 0.35–0.8 mm. in diameter, pulverulent, whitish; *uredospores* subglobose, ovoid, ellipsoid or rarely oblong, densely verrucose, epispore 1.5–2 μ thick, hyaline, 21–43 x 16–24 μ. *Telia* hypophyllous, usually gregarious in small groups (2–4 mm. wide), 0.35–0.5 mm. in diameter, often confluent, yellowish or brownish yellow, plane; *teliospores* clavate-cylindrical, apex thickened up to 20 μ thick, 62–100 x 19–25 μ.

ON GERANIACEAE

Coleosporium Geranii Pat.

On *Geranium strigosum*. **Yunnan**: Changshan, Tali, *4648*, *5063*, *5064*.

Telia hypophyllous, densely gregarious or scattered, often circinately arranged, confluent, roundish, 0.5–0.8 mm. in diameter, ochraceous buff, sometimes becoming black; *teliospores* cylindrical-clavate, rounded at apex, slightly attenuated at the base, 60–80 x 16–23 μ, apex 10–20 μ thick. This species was first described from western Yunnan by Patouillard in 1890 (Rev. Mycol. **12**: 135. 1890).

Coleosporium Evodiae Diet.

On *Evodia rutaecarpa*. **Hunan**: Yolushan, Changsha, *4502*, *4516*, *4571*. On *E. officinalis*. **Szechuan**: Kiating, *6854*. On *E.* sp. **Szechuan**: Kwanhsien, *8482*.

Coleosporium Xanthoxyli Diet. et Syd.

On *Xanthoxylum acanthopodium*. **Yunnan**: Shishan, Kunming, *7484*. On *X. alatum*. **Yunnan**: Wenshan, *4855*, *4856*, *4857*; Tachwang, *4349*; **Hunan**: Yolushan, Changsha, *4570*, *4686*.

ON LABIATAE

Coleosporium Plectranthi Barcl.

On *Plectranthus Bulleyanus*. **Yunnan**: Hsiakwan, Tali, *4561*. On *P. Coetsa*. **Yunnan**: Changshan, Tali, *4345*, *4559*; Chichushan, Pinchuan, *4556*. On *P. eriocalyx*. **Yunnan**: Kunming, *8081*, *8082*. On *P. phyllop-*

odus. **Yunnan**: Changshan, Tali, *4347*, *4560*, *4566*; Chichushan, Pinchuan, *4555*. On *P. sculponeatus*. **Yunnan**: Kunming, *4462*, *4544*, *8080*; Wenshan, *4346*, *4348*; Hsiakwan, Tali, *4562*. On *P. striatus*. **Yunnan**: Changshan, Tali, *4565*. On *P. nervosus*. **Szechuan**: Chengtu, *7541*.

Coleosporium Perillae Syd.

On *Perilla nankinensis*. **Yunnan**: Kunming, *5147*; **Szechuan**: Chengtu, *7540*. On *P. frutescens*. **Szechuan**: Chengtu, *6861*. On *Elsholtzia rugulosa*. **Yunnan**: Hsiakwan, Tali, *4561a*. On *E. Patrini*. **Yunnan**: Kunming, *4461*. On *E. ochroleuca*. **Yunnan**: Tali, *4563*.

ON SCROPHULARIACEAE

Coleosporium Pedicularidis sp. nov.

On *Pedicularis gracilis*. **Yunnan**: Changshan, Tali, August 24, 1938, *C. C. Cheo*, *4354*, **type!** *4457*. On *P. deltoides*. **Yunnan**: Tali, *4557*. On *P. racemosa*. **Yunnan**: Chichushan, Pinchuan, *4458*.

Uredíis amphigenis, plerumque hypophyllis, aggregatis vel sparsis, rotundatis, 0.25–0.7 mm. diam., pallide flavis, mox nudis, pulverulentis; *uredosporis* subglobosis, ovatis, ellipsoideis vel oblongis, grosse verrucosis, 18–30 x 13–20 μ, episporio 1.5–2 μ crasso.

Teliis amphigenis, dense gregariis vel sparsis, rotundatis, 0.2–0.5 mm. diam., ochraceis; *teliosporis* cylindraceis vel clavatis, apice modice incrassatis usque 13 μ, 54–83 x 17–26 μ.

ON RUBIACEAE

Coleosporium Leptodermidis (Barcl.) Syd.

On *Leptodermis glomerata*. **Yunnan**: Shishan, Kunming, *4344*. On *L. Potanini*. **Yunnan**: Changshan, Tali, *4343*, *5047*. On *L. Potanini* var. *glauca*. **Yunnan**: Changshan, Tali, *4548*. On *L. Potanini* var. *tomentella*. **Yunnan**: Kunming, *7483*, *8257*; Changshan, Tali, *4558*. On *L. pilosa* var. *microphylla*. **Yunnan**: Hsiakwan, Tali, *4538*.

Coleosporium Paederiae Diet.

On *Paederia foetida*. **Yunnan**: Tapuchi, Kunming, *8145*, *8146*.

Uredia hypophyllous, scattered, roundish, 0.3–0.5 mm. in diameter, naked, pulverulent; *uredospores* subglobose, ovate or ellipsoid, epispore 1.5–2 μ thick, hyaline, densely verrucose, 20–27 x 16–21 μ. *Telia* densely gregarious to scattered, ochraceous buff, roundish, or irregular in shape, usually confluent, 0.5–0.8 mm. in diameter; *teliospores* cylindrical, rounded at both ends, not or slightly narrowed toward the base, apex 7–10 μ swollen up to 27 μ thick, 64–99 x 18–23 μ.

This species was first discovered in Japan. It seems that only the uredial stage has been described.

ON CAMPANULACEAE

Coleosporium Campanulae (Pers.) Lev.

On *Asyneuma fulgens*. **Yunnan**: Kunming, *7479*; Hsiakwan, Tali, *4433a*. On *Wahlenbergia marginata*. **Yunnan**: Kunming, *8201*.

ON COMPOSITAE

Coleosporium Eupatorii Arth.

On *Eupatorium Lindleyanum*. **Kiangsu**: Nanking, *8436*.

Uredia hypophyllous, gregarious or scattered, sometimes circinately arranged, 0.35–0.5 mm. in diameter, roundish or irregular, finally naked, pulverulent, whitish when old; *uredospores* subglobose, ovate or ellipsoid, coarsely verrucose, epispore 1.5–2 μ thick, hyaline, 21–36 x 16–23 μ. *Telia* hypophyllous, densely gregarious in groups (1.5–3 mm. in diam.), 0.35–0.5 mm. in diameter, cinnamon brown, often surrounding uredia; *teliospores* cylindrical or cylindrical-clavate, yellowish, apex thickened (6–14 μ), 57–74 x 11–18 μ.

Coleosporium Carpesii Sacc.

On *Carpesium abrotaniodes*. **Yunnan**: Kunming, *8147*. On *C. cernum*. **Yunnan**: Wenshan, *4340*, *4341*; **Szechuan**: Omeishan, *6855*. On *C.* sp. **Yunnan**: Kaiyuan, *4809*.

Coleosporium Solidaginis Thuem.

On *Aster* sp. **Yunnan**: Kunming, *4336*, *4337*, *4338*; Kaiyuan, *4339*; Changshan, Tali, *4335*; **Hunan**: Yolushan, Changsha, *4482*. On *Callistephus chinensis*. **Yunnan**: Kunming, *4524*.

Coleosporium Inulae (Kunz.) Rabh.

On *Inula serrata*. **Yunnan**: Kunming, *8152*, *8158*.

Coleosporium Ligulariae Thuem.

On *Ligularia dictyoneura*. **Yunnan**: Changshan, Tali, *4539*. On *L. lapathifolius*. **Yunnan**: Kunming, *7478*.

Coleosporium Saussureae Thuem.

On *Saussurea peduncularis*. **Yunnan**: Chichushan, Pinchuan, *4473*, *4545*.

Coleosporium Senecionis Fr.

On *Senecio dianthus*. **Yunnan**: Chichushan, Pinchuan, *4464*. On *S. densiflorus*. **Szechuan**: Wenshan, *8483*.

MELAMPSORA Cast.

Melampsora Kusanoi Diet.

On *Hypericum patulum*. **Yunnan**: Kunming, *4469*, *4471*, *4850*, *6987*, *7604*, *8045*, *8756*; Chengkung, *7618*; Süanwei, *2046*. On *H. patulum* var. *Henryi*. **Yunnan**: Kunming, *4547*, *6894*.

Melampsora Ricini Pass.

On *Ricinus communis*. **Yunnan**: Kunming, *6879*; Kaiyuan, *5158*; Chengkiang, *4360*; Mengtze, *4862*; Lunan, *4361*; Tachwang, *4359*.

Melampsora coleosporoides Diet.

On *Salix heteromera*. **Yunnan**: Kunming, *7816*, *8484*, *5177*. On *S.* sp. **Yunnan**: Shihping, *6935*.

Melampsora Larici-epitea Kleb.

On *Salix Delavayana*. **Yunnan**: Changshan, Tali, *4552*. On *S. psilostigma*. **Yunnan**: Changshan, Tali, *4352*, *4353*, *4554*. On *S. longiflora*. **Yunnan**: Changshan, Tali, *4553*.

Melampsora Salicis-albae Kleb.

On *Salix* sp. **Yunnan**: Kunming, *8485*; **Szechuan**: Chengtu, *6823*.

Melampsora Salicis-Cavaleriei sp. nov.

FIGURE 2

On *Salix Cavaleriei*. **Yunnan**: Kunming, Nov. 10, 1942, *W. F. Chiu*, *7607*, **type**! *8486*.

Urediis epiphyllis, sparsis vel subgregariis, rotundatis, 0.2–0.5 mm. diam., mox nudis, aurantiacis; *uredosporis* angulato-subglobosis, oblongis vel clavatis, verrucosis, 18–37 x 11–18 μ, *episporio* 1.5–2 μ crasso, hyalino; *paraphysibus* capitatis, hyalinis.

Teliis epiphyllis, sparsis vel dense aggregatis, rotundatis, 0.2–0.5 mm. diam., pallide cinnamomeo-brunneis, subepidermicis; *teliosporis* cylindraceis, prismaticis vel clavato-cylindraceis, flavidis, apice truncatis vel rotundatis, 36–69 x 7–11 μ, *episporio* ubique 1–1.5 μ crasso.

This fungus is characterized by its epiphyllous uredia and telia, slender teliospores and angular uredospores. It differs from *M. Salicis-albae* in the epiphyllous uredia and telia and much longer teliospores.

Melampsora Rostrupii Wagner

On *Populus rotundifolia*. **Yunnan**: Kunming, *7579*. On *P.* sp. **Yunnan**: Changshan, Tali, *4358*.

Melampsora Larici-populina Kleb.

On *Populus yunnanensis*. **Yunnan**: Hsiakwan, Tali, *4357*; I-Liang, *4351*; Kunming, *4877*; Chichushan, Pinchuan, *4463*.

CEROTELIUM Arthur

Cerotelium Fici (Cast.) Arth.

On *Morus* sp. **Yunnan**: Kaiyuan, *4867*, *5157*, *5181*; Mengtze, *5156*.

Cerotelium desmium (Berk. et Br.) Arth.

On *Gossypium barbadense*. **Yunnan**: Kaiyuan, *4860*, *4868*, *4809*, *4870*; Shihping, *6371*.

PUCCINIACEAE

GERWASIA Raciborski

Gerwasia Rosae sp. nov.

FIGURE 5

On *Rosa cymosa* (=*R. microcarpa*). **Hunan**: Hengshan, Nov. 3, 1937, *C. C. Cheo, 4514*, **type**! and *4701*.

Teliis hypophyllis, subaggregatis vel sparsis, minutis, 0.17–0.25 mm. diam., subepidermicis, per stomata erumpentis, pulvinatis, pallidis; *teliosporis* in apice hypharum per stomata fasciculatarum erumpentium ortis, ovoideis vel ellipsoideis, 26–41 x 11–16 μ, *episporio* tenui, hyalino, levibus, pedicello brevi, statim germinantibus; *paraphysibus* peripheric io in apice hypharum per stomata fasciculatum erumpentum ortis, hyalinis, valde curvatis, episporio crasso, 33–51 x 7.8–9.2 μ.

Telia hypophyllous, subgregarious or scattered, roundish, pulvinate, 0.17–0.25 mm. in diameter, subepidermal, whitish, erumpent through stoma, with incurved, hyaline, thick-walled paraphyses at the periphery; teliospores and paraphyses formed superficially at the apex of a single or usually a bundle of sporogenous hyphae; *teliospores* ovoid or ellipsoid, thin-walled (less than 1 μ thick), hyaline, usually slightly attenuated at apex or rounded at both ends, 26–41 x 11–16 μ, germinating *in situ* by prolongation of the apex of the spore, forming a cylindrical 4-celled promycelium; *pedicel* short (up to 8.6 μ long), fragile, hyaline; *paraphyses* cylindrical, hyaline, strongly incurved, thick-walled, 33–51 x 7.8–9.2 μ.

This interesting rust fungus is similar to *Gerwasia Rubi* in the manner of forming teliospores, but differs in the bundle of stalk cells, instead of one or two as in *G. Rubi*, and in the presence of the peripheral paraphyses. The genus *Gerwasia* was established in 1909 by Raciborski on *G. Rubi* from Java. A second species, *G. fasciculata* also on *Rubus* sp., was recently described by Arthur and Cummins (Philippine Jour. Sci. **61**: 466. *pl. 2 fig. 1.* 1936) from the Philippines. The Philippine species also has incurved peripheral paraphyses.

The teliospore of the Hunan fungus is pedicellate, arising from the apex of a stalk cell, 2 or 4 in number. New spores may be produced laterally and successively right below the old spore. Sometimes the stalk cell fails to produce spores at its apex, but gives rise again to a bundle of sporogenous hyphae. The spores germinate *in situ* at once on maturity. In measuring the teliospores they have to be crushed out under the cover glass. The mature spores become emptied and shrunken after germination, only a few of those which are just beginning to germinate being normal in shape and size. The rest are young spores. In one of the many sections of the telium studied by the writer only a single stalk cell was found, bearing at its apex paraphyses and teliospores. The stalk cells, however, usually are grouped in a bundle.

In two of the mountings, uredospores and teliospores of a *Phragmidium* were present. A subsequent search was made for the uredia and telia on the

specimens, but without result. The uredospores are subglobose or ellipsoid, verruculose, hyaline, and measure 20–26 x 16–20 μ (epispore 1.5–2 μ thick). The teliospores are cylindrical, 4–6 (rarely only 2) septate, rounded at both ends, chestnut brown and measure 60–103 (including the apiculum 7–11 μ long) x 29–34 μ; pedicel up to 103 μ long, 13–19 μ broad and asperulate below. This fungus fits well with the description of *Phragmidium mucronatum* to which it is referred.

HEMILEIA Berk. et Br.

Hemileia vastatrix Berk. et Br.

On *Coffea arabica*. **Yunnan**: Hokow, *4368*.

TRANZSCHELIA Arth.

Tranzschelia suffusca (Holw.) Arth.

On *Pulsatilla cernua*. **Szechuan**: Chengtu, *6860*.

Tranzschelia Pruni-spinosae (Pers.) Diet.

On *Prunus persica*. **Yunnan**: Chengkung, *4412*; Kaiyuan, *4532*.

HAMASPORA Koernicke

Hamaspora sinica Tai et Cheo

On *Rubus Parkeri*. **Kweichow**: Meitan, *7933*. On *R.* sp. **Hunan**: Hwanhsien, *5054*; **Szechuan**: Penghsien, *8047*. On *R. phenicolasius*. **Hunan**: Hengshan, *4740*, *4744*, *4741*, *4743*; Yolushan, Changsha, *4714*, *4739*.

Hamaspora benguetensis Syd.

On *Rubus ellipticus* var. *obcordatus*. **Yunnan**: Kweishan, Nangkiao, *6627*.

Uredia hypophyllous, more or less gregarious, confluent, roundish, 0.35–0.5 mm. in diameter, pulverulent, cinnamon brown; *uredospores* globose, subglobose or ovate, echinulate, pale cinnamon brown epispore 1.5–2 μ thick, 17–23 x 15–18 μ; *paraphyses* numerous, cylindrical or clavate, pale cinnamon brown often sharply pointed at apex, strongly curved, 43–51 x 8–11 μ.

PHRAGMIDIUM Link

Phragmidium pauciloculare (Diet.) Syd.

On *Rubus parvifolius*. **Yunnan**: Kunming, *6981*; Shihling, Lunan, *7652*; **Hunan**: Hwanhsien, *5056*. On *R. rosaefolius*. **Hunan**: Hengshan, *4578*, *4736*. On *R.* sp. **Szechuan**: Shehung, *7612*. On *R. subornatus*. **Yunnan**: Hwaling, *7683*.

Phragmidium Rubi-parvifolii Liou and Wang is no doubt identical with the present species.

Phragmidium brevipedicellatum Hiratsuka f.

On *Potentilla Kleiniana*. **Yunnan**: Kunming, *8014*; Sungming, *4796*.

Uredia amphigenous, chiefly hypophyllous or on petioles, densely gregarious, often in circular groups to scattered, "orange chrome" in color, naked, 0.25–1 mm. in diameter, pulverulent, roundish or elliptic, oblong on petioles; *uredospores* subglobose, globose, ellipsoid or piriform, finely echinulate, epispore 1–1.5 μ thick, hyaline, contents orange yellow and granular when fresh, 17–24 x 13–21 μ; *paraphyses* numerous, cylindrical-clavate, straight or more or less curved, thin-walled, hyaline, 63–84 μ long, 7–8 μ wide (up to 11 μ) at the broadest part; *pores* indistinct. *Telia* hypophyllous, scattered, pulvinate, roundish, about 0.5 mm. in diameter, black; *teliospores* cylindrical, 2–4 septate, mostly 3–4, rarely 2, not or slightly constricted at septum, epispore 2–2.5 μ thick, smooth, dark chestnut brown, uniform in thickness, sometimes thicker at the apex (up to 4 μ), rounded at both ends, non-papillate at apex, 40–63 x 21–24 μ, 3 germ *pores* in each cell; *pedicel* short, hyaline, non-hygrophorous, 17–49 μ long, 7–9 μ wide, tapering below.

The teliospores of the Yunnan forms are smaller than those given in the original diagnosis ("42–93 x 21–30 μ").

Phragmidium mucronatum (Fr.) Schl.

On *Rosa odorata*. **Yunnan**: Kunming, *7566*, *6873*, *7565*, *7571*. On *R.* sp. **Kansu**: Langchow, *8387*.

The length of the teliospore is variable: usually the spore measures 60–110 μ in length, but sometimes up to 144 μ long on the same host collected in the same locality. The septation varies from 3 to 7, commonly 4–5, rarely 3 or 7.

Phragmidium Rosae-rugosae Kasai

On *Rosa omeiensis*. **Yunnan**: Chichushan, Pinchuan, *4370*, *4765*. On *R.* sp. **Kweichow**: Tsechoa, *8442*.

The aecial stage reported in Japan has not been collected. The brown or chestnut brown color of the telia and the golden brown teliospores distinguish the species. The septation of the teliospores of the Yunnan plant is 4 to 7, commonly 6, rarely 2 or 3, while that of the Japanese plant is 5–10, generally 7.

NYSSOPSORA Arthur

Nyssopsora Cedrelae (Hori) Diet.

On *Spondias axillaris*. **Hunan**: Yolushan, Changsha, *4480*, *4724*, *4731*, *4749*.

Telia amphigenous, chiefly hypophyllous, if epiphyllous always along the middle main vein, roundish, 1–1.5 mm. in diameter, pulverulent, black; *teliospores* subglobose, polygono-globose or piriform, the lower cell usually compressed, 30–37 μ long, 23–34 μ broad, not or slightly constricted at septum, brownish black, opaque, processes 14–27 in number, 2–3 branched at apex, olivaceous brown, 6–9 μ long, 2–3 μ broad; *pedicel* hyaline, 63–90 x 7–9 μ, minutely asperulate.

PILEOLARIA Castagne

Pileolaria Terenbinthi (DC.) Cast.

On *Pistacia weinmannifolia*. **Yunnan**: Hualing, *4452*; Kaiyuan, *5073*.

Pileolaria Shiraiana (Diet. et Syd.) Ito

On *Rhus Delavayi* var. *quinquejuga*. **Yunnan**: Kunming, *7004*.

The Kunming form has larger teliospores (24–41 μ high, 36–46 μ wide against "18–36 μ high, 25–37 μ" wide (Ito)) and longer pedicels (30–52 μ long against "35 μ" (Ito)).

RAVENELIA Berk.

Ravenelia Indigoferae-scabridae sp. nov.

On *Indigofera scabrida*. **Yunnan**: Shishan, Kunming, December 1938, *F. L. Tai, 4632*, **type!** *4446, 4447, 5043, 7790, 7792, 7794*; Kütsing, *7791*; Hsiakwan, Tali, *4643, 7793*.

Urediis hypophyllis, sparsis vel aggregatis, rotundatis, 0.5–1 mm. diam., pulverulentis, "Hazel brown" (Ridgway); *uredosporis* subglobosis, obovoideis vel ellipsoideis, dense echinulatis, episporio 1.5-2 μ crasso, hyalino vel subhyalino, 20–27 x 17–24 μ; *poris germ.* 8, sparsis instructis; *paraphysibus* capitatis, superne flavidis vel brunneolis, deorsum pallidioribus, 6–83 μ longis, apice, 21–30 μ crassis.

Teliis amphigenis, plerumque hypophyllis, minutis, 0.5–1 mm. diam., epidermide rupta cinctis, aggregatis, plerumque circinatim dispositis, confluentibus, pulverulentis, atris; *capitulis teliosporarum* hemisphaericis, 83–131–(144) μ diam., castaneo-brunneis, levibus, e sporis 5–8 in omni directione compositis, sporis singulis unicellularibus, 26–37 μ altis, 16–18 μ latis, *episporio* ad apicem 6–9 μ crasso; *cystidiis* capitulo adpressis, tam numerosis quam sporae singulae; pedicello hyalino, brevi.

Ravenelia macrocapitula sp. nov.

On *Indigofera Hancockii*. **Yunnan**: Chichushan, Pinchuan, Sept. 16, 1938, *H. S. Yao, 7787*, **type!** *Changshan, Tali 7786*. On *Indigofera Dielsiana*. **Yunnan**: Changshan, Tali, *5042*.

Urediis hypophyllis, sparsis vel aggregatis, 0.5–0.8 mm. diam., confluentibus, pulverulentis, "Sanford's brown" (Ridgway); *uredosporis* globosis vel late ovatis, pallide flavidis vel subhyalinis, remoteque verruculosis, 21–26 x 21–23 μ, episporio 1.5–2 μ crasso, *poris germinativis* 6 sparsis instructis; *paraphysibus* numerosis, spathulatis vel capitatis, 63–86 μ longis, apice flavis vel flavo-brunneis, 20–26 μ latis, deorsum hyalinis, asperulatis.

Teliis amphigenis, sparsis vel dense aggregatis, subepidermicis, 1–1.5 mm. diam., atro-brunneis; *capitulis teliosporarum* leniter convexis, 99–142 μ diam., castaneo-brunneis, ex sporis 6–9 in omni directione compositis, sporis omnibus papillis 4–8 rectis vel subinde curvulis hyalinis usque 4 μ longis, ca. 1.5 μ latis obsitis; sporis singulis bicellularibus, 40–49 μ altis, 16–21 μ latis, episporio ad apicem 6–9 μ crasso; *cystidiis* tam numerosis quam sporae singulae, capitulo adpressis; pedicello hyalino, brevi.

This species is distinct from *R. Indigoferae* in the larger telio-heads and slightly smaller uredospores and from *R. Schroeteriana* in the slightly larger uredospores and larger telio-heads.

Ravenelia laevis Diet. et Holway

On *Indigofera cinerascens*. **Yunnan**: Kunming, *6978, 7788, 7789*. On *I.* sp. **Yunnan**: Kunming, *5040*.

R. Mitteri Syd. seems to differ from *R. laevis* only in the smaller uredospores and somewhat smaller telio-heads.

Ravenelia japonica Diet. et Syd.

On *Albizzia kalkora*. **Hunan**: Yolushan, Changsha, *4487*, *4682*, *4712*, *4725*. On *A. julibrissin*. **Szechuan**: Chengtu, *6824*.

GYMNOSPORANGIUM Hedw. f.

Gymnosporangium clavariaeforme (Jacq.) DC.

On *Craetagus scabrifolius*. **Yunnan**: Lutien, *4537*; Tungchuan, *4591*.

Gymnosporangium Haraeanum Syd.

On *Pyrus* sp. **Yunnan**: Süanwei, *4872;* Lutien, *4820*. On *Chaenomeles sinensis*. **Yunnan**: Süanwei, *4871*.

Gymnosporangium Cunninghamianum Barcl.

FIGURE 8

On *Cupressus Duclouxiana*. **Yunnan**: Kunming, *8097*, *8162*, *8197*.

Telia on green and woody twigs, sorus-bearing part of the woody twig slightly enlarged, 1.5–6.5 cm. long, 0.5–10 mm. wide, in rows on woody twigs, solitary on green twigs, hemispheric, loaf- or tongue-shaped, 1.5–3 mm. in diam., 1.5–4 mm. high (hemispheric), 4 mm. long, 2–3 mm. high (oblong), "carob brown"; *teliospores* ellipsoid or ellipsoid-oblong, rounded or usually acute at both ends, epispore of thin-walled spores 2–3 μ thick, cinnamon brown, thick-walled, 3–4 μ thick, chestnut brown, smooth, contents granular, not or slightly constricted at septum, thin-walled spores measuring 53–67 x 24–30 μ, thick-walled 57–63 x 29–36 μ (broadly ellipsoid); *pores* 4–6 in each cell in a transverse zone near the septum or in two zones, those near the apex in the upper cell, and near the base in the lower cell being only one or two in number; *pedicel* long and slender up to 435 μ long.

The teliospores of this species are said to have 1 or 2 pores near the septum, but those of the Yunnan fungus as described above have 4–6 pores in a transverse zone or in two zones.

Gymnosporangium japonicum Syd.

On *Photinia villosa*. **Hunan**: Yolushan, Changsha, *4709*, *4684*.

Gymnosporangium juniperinum (L.) Mart.

On *Sorbus Valbrayi*. **Yunnan**: Changshan, Tali, *4362*.

Gymnosporangium nipponicum Yamada

On *Sorbus alnifolia*. **Kweichow**: Kiangkowhsien (Fang Ching Shan), *S. Y. Cheo 503*.

Pycnia epiphyllous. *Aecia* gregarious in groups 6–7 mm. wide, on swollen parts, cylindrical, 1.5–2 mm. long, 0.2–0.3 mm. wide, brownish yellow, lacerate at apex; *aeciospores* subglobose, globose or rarely broadly ovate,

epispore 2–3 μ thick, yellow or ochraceous yellow, minutely and densely verrucose, 24–31 x 21–26 μ; *peridial cells* rhomboid in face view, 49–86 x 26–47 μ, inner wall 5–18 μ thick, verruculose with papillae, outer wall smooth, 3–4 μ thick; *pores* 6–8 scattered.

The present collection was determined by Dr. I. H. Crowell as *G. Miyabei* Yamada et Miyake. It seems to the writer that the aeciospores of this collection are too large for that species (24–31 x 21–26 μ against "18–24 x 18–22 μ" of *G. Miyabei*) and are also thicker-walled (2–3 against "1–1.5" of *G. Miyabei*). It is very close to *G. nipponicum*.

Gymnosporangium wenshanense sp. nov.

On *Photinia serrulata*. **Yunnan**: Matan, Wenshan, Aug. 15, 1938, *T. H. Wang & S. T. Chao, 4363*, **type!**

Pycniis gregariis, epiphyllis, 0.2–0.25 mm. diam. *Aeciis* amphigenis, plerumque hypophyllis, maculis decoloratis incrassatulis insidentibus, in greges rotundatos 1.5–5 mm. latos dense vel annulatim dispositis, cupulatis, 0.3–0.5 mm. diam., margine lacerato; *cellulis peridii* rhomboideis, 21–34 x 21–29 μ, pariete interiore 4–5 μ crasso, minute verrucoso, exteriore levi 7–10 μ crasso; *sporis* angulato-globosis vel subglobosis, dense et minute verruculosis, *episporio* 2–3 μ crasso, hyalino, 23–30 x 18–23 μ; *teliosporis* adhuc ignotis.

The present collection differs from *Aecidium Pourthieae* Syd. in the larger and thicker-walled aeciospores and larger peridial cells. It is also distinct from *Gymnosporangium japonicum* in the cupulate aecia and other characters.

MAINSIA Jackson

Mainsia chinensis (Diet.) Jackson

On *Rubus Swinhoei* var. *hupehensis*. **Szechuan**: Kwanhsien, *8427*. On *R. setchuenensis*. **Szechuan**: Kwanhsien, *8428*. On *R.* sp. **Hunan**: Hengshan, *4737*.

UROMYCES Unger

Uromyces Alopecuri Seym.

On *Alopecurus pratensis*. **Yunnan**: Kunming, *7217, 5026*.

Uromyces coronatus Miyabe et Nishida

On *Zizania latifolia*. **Szechuan**: Chengtu, *6825*.

Uromyces tenuicutis McAlpine

On *Sporobolus indicus*. **Yunnan**: Kunming, *2914*; **Szechuan**: Chengtu, *7543a*.

Uredia amphigenous, chiefly epiphyllous, gregarious or scattered, elliptic or oblong, covered by epidermis, then ruptured by a longitudinal slit, 1–1.5 mm. long, 0.2–0.3 mm. wide, pulverulent, cinnamon brown; *uredospores* ellipsoid, globoid or broadly ovate, sparingly echinulate, pale cinnamon brown, epispore about 1.5 μ thick, 27–36 x 20–24 μ; *pores* 4–5 equatorial.

Uromyces inaequalitus Lasch.

On *Stellaria sexatilis*. **Yunnan**: Kunming, *4411, 7650*.

Uromyces MacIntirianus Barcl.

On *Hemigraphis* sp. **Yunnan**: Kaiyuan, *4810*.

Telia hypophyllous, densely gregarious in orbicular groups (2–5 mm. in diam.), confluent, 0.25–0.35 mm. in diameter, at first covered by epidermis, finally erumpent, compact, blackish brown; *teliospores* ovate, ovate-oblong, clavate or subglobose, rounded or angular at apex, slightly thickened at apex (3–4 μ), attenuated below, epispore about 2 μ thick, cinnamon brown, smooth, 20–36 x 16–24 μ; *pedicel* persistent, long, up to 64 μ long, hyaline or tinted; few 2-celled *spores* (about 2%) present, ellipsoid or rarely clavate, epispore 2–3 μ thick, apex slightly thickened (3–4 μ), cinnamon brown, smooth, not or slightly constricted at septum, 31–49 x 20–23 μ, rounded at apex, usually slightly attenuated at the base, pore of the upper cell apical, that of the lower at the septum; *pedicel* persistent and long.

Uromyces Sophorae-viciifoliae sp. nov.

FIGURE 18

On *Sophora viciifolia*. **Yunnan**: Lunan, December 26, 1938, *T. F. Yu, S. T. Chao & T. H. Wang, 4415*, **type!** Kunming *5277*; Tachwang, *4767*.

Urediis amphigenis, sparsis vel subgregariis, confluentibus, bullatis, epidermide fissa cinctis, rotundatis, 0.5–1 mm. diam., pulverulentis, cinnamomeo-brunneis; *uredosporis* subglobosis, ellipsoideis vel oblongis, echinulatis, 23–30 x 16–20 μ, episporio 1–1.5 μ crasso, pallide cinnamomeo-brunneo; *poris germinativis* 4 aequatorialibus instructis.

Teliis conformibus, pulverulentis, atrobrunneis; *teliosporis* ellipsoideis vel cylindraceis, rarius subglobosis, apice rotundatis vel attenuatis, leniter incrassatis (3–6 μ), basi rotundatis vel plerumque attenuatis, castaneo-brunneis, levibus, 24–47 x 14–19 μ, episporio 1.5–2 μ crasso; *pedicello* hyalino, brevi.

Uromyces decoratus Syd.

On *Crotalaria lonchophylla*. **Yunnan**: Hsiakwan, Tali, *4644*.

Uromyces striatus Schroet.

On *Trifolium repens*. **Yunnan**: Kunming *5049*; Sungming, *4423*.

Uromyces punctatus Schroet.

On *Astragalus sinicus*. **Yunnan**: Panchi, *7682*.

Uromyces Lespedezae-procumbentis (Schw.) Curt.

On *Lespedeza juncea*. **Yunnan**: Kunming, *6974*. On *L. bicolor*. **Hunan**: Hengshan, *4486, 4723*. On *Kummerovia striata*. **Hunan**: Yolushan, Changsha, *4483*.

Dr. Naohide Hiratsuka has separated the form on *Kummerovia striata* as a distinct species: *U. Itoanus*. After a careful study of the forms on *Kummerovia* and *Lespedeza* by the writer, no appreciable difference has been found to distinguish them as distinct species.

Uromyces rugulosus Pat.

FIGURE 24

On *Campylotropis polyantha*. **Yunnan**: Kunming, *4534*, *5052*, *7200*, *7601*; Chengkung, *7527*; Kütsing, *7798*. On *C. Balfouriana*. **Yunnan**: Kunming, *5075*, *5077*, *7199*. On *C. hirtella*. **Yunnan**: Kunming, *4530*, *7198*, *7232*, *7602*.

Uredia amphigenous, scattered or subgregarious, roundish, 0.3–0.5 mm. in diameter, pulverulent, cinnamon brown; *uredospores* subglobose or ovate, echinulate, epispore 1.5–2 μ thick, yellowish or subhyaline, 18–29 x 14–21 μ; *paraphyses* numerous, cylindrical, thick-walled, straight or curved, up to 86 μ long, 7–8.5 μ wide, golden yellow or subhyaline. *Telia* amphigenous, mostly hypophyllous, scattered or subgregarious, sometimes confluent, covering the entire leaf surface, roundish or irregular in shape, 0.3–0.5 mm. in diameter, pulverulent, blackish brown; *teliospores* subglobose, ovate or oblong, rounded at apex which is provided with a flattened cinnamon brown papilla (1–3 μ high), base rounded or slightly attenuated, epispore 2.5–3.5 μ thick, verrucose, chestnut brown, 21–36–(41) x 16–23 μ; *pedicel* hyaline, as long as the spore.

The teliospores of the form on *Campylotropis polyantha* are slightly smaller than those on other species of *Campylotropis*. *Uromyces rugulosus* was described from Yunnan by Patouillard in 1888 (Jour. de Bot. **2**: 151. 1888), only the telial stage being known. Liou and Wang's *Uromyces Lespedezae-macrocarpae* (Contr. Inst. Bot. Nat. Acad. Peiping **3**:30. 1935) is evidently identical with the former. They also described only the telial stage.

Uromyces Phaseoli typica Arth.

On *Phaseolus vulgaris*. **Yunnan**: Kunming, *4401*; Tali *4404*; Kaiyuan, *5162*; Chengkung, *4822*.

Uromyces Phaseoli Vignae Arthur

On *Vigna sinensis*. **Yunnan**: Kunming, *4832*; Pinchuan, *4863*; Kaiyuan, *4834*, *4835*; Hualing, *4830*, *4831*; I-Liang, *5182*.

Uromyces Ervi (Wallr.) West

On *Vicia tetrasperma*. **Yunnan**: Kunming, *7395*.

Uromyces Kondoi Miura

FIGURE 25

On *Gueldenstaedtia Delavayi*. **Yunnan**: Lungtan, Süanwei, *8487*.

Uredia amphigenous, scattered or gregarious, roundish, naked, surrounded by ruptured epidermis, sometimes confluent, 0.3–1 mm. in diameter, pulverulent, cinnamon brown; *uredospores* globose, finely echinulate, pale cinnamon brown, epispore 2–3 μ thick, 20–23 μ in diameter; *pores* 4 scattered. *Telia* amphigenous, mainly hypophyllous, naked, roundish, 0.3–1 mm. in diameter, compact, chestnut brown; *teliospores* ovate or sub-

globose, densely verruculose, epispore 2–3 μ thick, chestnut brown, with a small flat or hemispheric yellowish papilla at apex, 23–28 x 16–21 μ; *pedicel* short, hyaline, fragile.

Uromyces Gueldenstaedtiae Liou et Wang was evidently published without the knowledge of Miura's species. In the original diagnosis of both *U. Kondoi* and *U. Gueldenstaedtiae* only the telial stage was reported. This species is close to *U. Genistae-tinctoriae*, but differs in the globose uredospores with 4 scattered pores and the slightly larger, thicker-walled and darker-colored teliospores which are never verrucose in striae.

Uromyces Fabae (Pers.) DeBary

On *Vicia sativa*. **Yunnan**: Chengkung, *7250*. On *V. Faba*. **Yunnan**: Kunming, *4425*, *5978*; I-Liang, *4853*; Kaiyuan, *5170*; Tachwang, *5165*.

Uromyces Geranii (DC.) Fries

On *Geranium nepalense*. **Yunnan**: Kunming, *7649a*.

Uromyces bidenticola (P. Henn.) Arth.

On *Bidens pilosa*. **Yunnan**: Shihling, Lunan, *7651*.

Uredia amphigenous, or caulicolous and on petioles, gregarious or scattered, roundish, surrounded by ruptured epidermis, 0.5–1 mm. in diameter, pulverulent, chestnut brown; *uredospores* subglobose, ovoid or ellipsoid, echinulate, epispore 2–3 μ thick, yellowish, 27–38–(44) x 20–29 μ; *pores* 2 approximately equatorial.

Uromyces Polygoni (Pers.) Fckl.

On *Polygonum aviculare*. **Yunnan**: Hsiakwan, Tali, *5006*; **Szechuan**: Lanchung, *6826*.

PUCCINIA Pers.

ON GRAMINEAE

Puccinia Sorghi Schw.

On *Zea Mays*. **Yunnan**: Kunming, *7945*; Chengkiang, *4385*; Kaiyuan, *4824*; **Kansu**: Hweihsien, *8411*.

Puccinia Eulaliae Barcl.

On *Erianthus fastigiatus*. **Yunnan**: Kunming, *7617*. On *Miscanthus sinensis*. **Fukien**: Yungan, *7500*. On *M. japonicus*. **Hunan**: Hengshan, *4669*; Yolushan, Changsha, *4685*. On *Miscanthus* sp. **Hunan**: Hengshan, *4688;* Yolushan, Changsha, *4763*. On *Saccharum* sp. **Kiangsu**: Chinkiang, *8376*. On *Sorghum vulgare*. **Kiangsu**: Nanking, *7620*.

Re-examination of the rust on *Erianthus fulvus* collected by the writer at Nanking in 1928 and identified by Mr. H. Sydow as *Puccinia purpurea* (Ann. Mycol. **27**: 419. 1929) shows that it is also this species.

Puccinia Eulaliae according to the description differs from *P. Miscanthi* Miura in the shorter and narrower teliospores and the ovate-piriform uredospores. In the original diagnoses of these two species, however, uredospores

were described in both cases only from those intermixed with teliospores. And in the case of *P. Eulaliae* the number and position of the germ-pores of the uredospores were not given. The writer in the course of studying rust collections from different parts of China found forms agreeing closely with *P. Eulaliae* except that the teliospores are larger (30–57 x 14–24 μ). The uredospores of these forms have 4–5 equatorial pores. *P. Miscanthi* is certainly distinct in its globose and verrucose uredospores with 10 scattered pores. Teng (Sinensia **8**:256. 1937) considered *P. Miscanthi* as a synonym of *P. Eulaliae*. The question of whether or not these are identical could be settled only by a comparative study of the type specimens of these two species.

On account of the large size of the teliospore of the Chinese form, they are often referred to *P. Miscanthi* in this country. Thus, the present writer erroneously referred in a previous publication (Nanking Jour. **2**: 175. 1932) a *Puccinia* on *Miscanthus sinensis* to the latter species. It should be identified as *P. Eulaliae*.

Puccinia erythropus Diet.

On *Miscanthus japonicus*. **Hunan**: Hengshan, *4492*, *4657*, *4665*, *4683*; **Szechuan**: Chengtu, *7546*.

P. erythropus differs from *P. Eulaliae* macroscopically in the larger telia, ellipsoid or ellipsoid-oblong teliospores and thicker-walled smaller uredospores which are sometimes thickened at their apex.

Puccinia Pollinae-quadrinervis Diet.

On *Eulalia quadrinervis*. **Yunnan**: Kunming, *5028*, *7231*. On *Eulalia*, sp. **Yunnan**: Panchi, *7674*.

Puccinia Kühnii (Krug.) Butler

FIGURE 9

On *Saccharum spontaneum*. **Yunnan**: Kunming, *8291*, *8377*.

Uredia hypophyllous, also on leaf sheath, oblong or linear, scattered or usually seriate, 0.5–2.5 mm. long, 0.2–0.5 mm. wide, at first covered by epidermis, finally ruptured by a longitudinal slit, usually at the sides, orange yellow when fresh, pulverulent; *uredospore* subglobose, ellipsoid or piriform with orange contents, echinulate, epispore 1.5–2 μ thick, subhyaline or yellowish, 27–39 x 17–24 μ; *pores* 4 equatorial. *Telia* hypophyllous, roundish, elliptic, oblong or linear, scattered or seriate, 0.35–2 mm. long, 0.2–0.8 mm. wide, pulvinate, brownish black; *teliospores* ellipsoid or occasionally subglobose, broadly ovate or oblong, rounded at both ends, rarely truncate or obtusely acuminate at the apex, pore of the upper cell apical or slightly depressed, of the lower, at the septum, apex thickened (4–7 μ), 1.5–2 μ thick at sides, smooth, not constricted at septum, cinnamon brown, 36–56 x 14–21 μ; *pedicel* brownish, 3 times as long as the spore or longer (up to 139 μ long), often laterally attached; *paraphyses* clavate or cylindrical, brownish or hyaline, 43–77 μ long, the apical part 10–18 μ wide, walls of the apex 3–6 μ thick, 1.5–2 μ thick at sides below.

The collections above listed are referred to *Puccinia Kühnii* with some hesitation, as the uredospores of the present fungus are smaller and the teliospores much larger, borne on long pedicels, than those of *P. Kühnii*. Also the uredospores are not thickened at apex. A comparison has been made of the present fungus with one on *Saccharum arundinaceum* collected by the writer at Nanking in 1928 (Univ. Nanking Path. Herb. no. 2802) and identified by Mr. Sydow as *P. Kühnii*. The latter form has larger uredospores (26–46 x 18–31 μ), some of which have a thickened apex.

Teng and Ou's *Puccinia Kühnii* (Sinensia **8**:259. 1937) on *Saccharum narenga* is apparently *P. Eulaliae*.

Puccinia filipodia Cummins

On *Heteropogon contortus*. **Yunnan**: Kunming, *4422*, *7658*; **Szechuan**: Shehung, *7613*.

Uredia amphigenous, chiefly epiphyllous, elliptic or linear, gregarious or scattered, 0.5–0.6 mm. long, at first covered by epidermis, finally ruptured by a longitudinal slit, ferruginous, pulverulent; *uredospores* globose, subglobose, broadly ellipsoid or ovate, epispore 2–3 μ thick, cinnamon brown, finely echinulate, 24–34 x 26–30 μ; *pores* 6–11, scattered.

Puccinia Cesatii Schroet.

On *Andropogon annulatus*. **Yunnan**: Paosi, *4814*; Lunan, *5031*; **Szechuan**: Chengtu, *4426*.

Puccinia erythraeensis Pazschze

On *Andropogon micranthus*. **Yunnan**: Kunming, *5029*, *5030*, *7623*; Paosi, *5076*; **Hunan**: Hengshan, *4674*, *4700*, *5038*; **Szechuan**: Chengtu, *7555*.

The fungus of the collections above listed has larger teliospores (31–39 x 23–32 μ) than those of *Puccinia Andropogonis-micranthi* Diet., and the teliospores are often slightly thickened (4–6 μ) at the apex. It agrees rather closely with *P. erythraeensis* which differs from *P. Andropogonis-micranthi* mainly in the slightly larger size and slightly thickened apex of the teliospore. The latter may be synonymous with the former.

Puccinia Duthiae Ell. et Tracy

On *Andropogon* sp. **Yunnan**: Mengtze, *5036*.

Uredia amphigenous, mainly hypophyllous, scattered or densely gregarious in orbicular or oblong groups, roundish or oblong, 0.5–1 mm. long, chestnut brown; *uredospores* globose, subglobose, or rarely ovoid, echinulate, pale chestnut brown, epispore 1.5–3.5 μ thick; *pores* 5–6 equatorial, 26–36 x 20–26 μ. *Telia* similar, confluent, pulvinate, black; *teliospores* ovate, broadly ellipsoid or oblong, rounded at both ends, rarely cuneate at apex, or slightly attenuated at the base, apex thickened (up to 6 μ thick) 3–4 μ thick at sides, dark chestnut brown, not or slightly constricted at septum, smooth, 33–53 x (17)–21–30 μ; *pedicel* persistent, brownish, up to

108 μ long, often laterally attached; *mesospores* present; *paraphyses* copious, capitate, yellow or yellowish brown.

The uredial stage of *P. erythraeensis* is often confused with that of this species. The uredospores of *P. Duthiae* are slightly larger, thicker-walled, and darker-colored than those of the former.

Puccinia Polliniae Barcl.

On *Strobilanthes dryadum*, O & I. **Yunnan**: Chichushan Pinchuan, *4329*. On *Microstegium* (*Eulalia*) *vimineum* ? II. **Yunnan**: Kunming, *3034*.

Puccinia Arundinellae-setosae sp. nov.

FIGURE 6

On *Arundinella setosa*. **Yunnan**: Kunming, November 1939, *F. L. Tai, 4813*, **type!** *7575, 7611*. On *Sporobolus indicus*. **Szechuan**: Chengtu, *7543*.

Urediis amphigenis, rotundatis vel oblongis, seriatim dispositis, numerosis, 0.35–1 mm. longis, pulverulentis, fuscis; *uredosporis* ellipsoideis, late ovatis vel subglobosis, echinulatis, 21–30 x 18–21 μ, castaneo-brunneis, episporio 2–2.5 μ crasso, *poris germinativis* 3–5 aequatorialibus praeditis; *paraphysibus* numerosis, capitatis vel clavatis, brunneolis vel castaneis.

Teliis conformibus, pulvinatis, atris; *teliosporis* ellipsoideis vel ovato-oblongis, apice leniter incrassatis (2–4 μ), rotundatis, basi plerumque attenuatis vel rotundatis, castaneis, levibus, medio non vel leniter constrictis, saepe oblique vel verticaliter septatis, 30–43 x 16–21 μ, episporio 1.5 μ crasso; *pedicello* brevi, castaneo, subinde lateraliter inserto, *mesosporis* immixtis.

This rust fungus differs from all the other species of *Puccinia* on *Arundinella* by the smaller teliospores with short pedicel and the paraphysate uredia.

Puccinia Arundinellae-anomalae Diet.

On *Arundinella anomala*. **Hunan**: Yolushan, Changsha, *4760, 4583, 4582, 4517*; Hengshan, *4493, 4581, 4752, 4726*; Hwanhsien, *5032*.

Puccinia Arundinellae Barcl.

On *Arundinella setosa*. **Yunnan**: Kunming, *7593a, 7576, 7609*. On *A. nepalensis*. **Yunnan**: Kunming, *7916*. On *A.* sp. **Yunnan**: Tali, *7082*.

Uredia amphigenous, oblong or linear, seriate, long covered by epidermis, later opened by a longitudinal slit, 0.5–1.5 mm. long, pulverulent, orange yellow; *uredospores* subglobose, ovoid or ellipsoid, epispore 1.5–2 μ thick, verrucose-echinulate, 24–33 x 20–24 μ; *pores* obscure. *Telia* amphigenous, mainly hypophyllous, also on the sheath, at first covered by epidermis, finally naked, elliptic, seriate, 0.5–1.5 mm. long, 0.35–0.5 mm. broad, pulvinate, brownish black to black; *teliospores* various in shape, ellipsoid, ovate-oblong, oblong rarely subglobose, sometimes clavate, rounded at both ends, sometimes tapering either towards the apex or towards the base, rarely truncate at apex, thickened at apex (4–9 μ), 2–3 μ thick at sides, not or slightly constricted at the septum, epispore chestnut brown, smooth, pore of the upper cell apical or slightly depressed, that of the lower at the septum,

37–56 x 21–29 μ; *pedicel* persistent, yellowish, up to 3 times as long as the spore, occasionally obliquely attached; *mesospores* present.

The telial stage agrees well with the description of *Puccinia Arundinellae* as given by the Sydows in their Monographia Uredinearum (**1**:732. 1904) in which the uredial stage was not mentioned. A short description of that stage was, however, published in 1907 by the Sydows and Butler (Ann. Mycol. **5**:499. 1907). Uredia were found associated with the telial stage in the Yunnan collections nos. *7576* and *7609*. The characters of the two sori are similar except that the telia are pulvinate and brownish-black or black, while the uredia are pulverulent and orange yellow in color. Uredospores have also been found intermixed with teliospores in the telia. The uredospores as found by the present writer are different from those described by the previous authors. They are larger, with hyaline walls and orange-yellow contents. The *Uredo* attributed to *P. Arundinellae* by the Sydows and Butler may belong to some other species of *Puccinia*, the telial stage of which is yet to be discovered.

Puccinia levis (Sacc. et Bizz.) Magnus

On *Digitaria sanguinalis*. **Yunnan**: Kaiyuan, *4764*; **Szechuan**: Chengtu, *4431*.

Puccinia polysora Underw.

On *Setaria Forbesiana*. **Yunnan**: Kunming, *7535*, *7631*.

Puccinia sinica Syd.

On *Muehlenbergia Huegelii*. **Kiangsu**: Nanking, Univ. Nanking Path. Herb. no. *2254*.

Puccinia sinica was published in 1929 (Ann. Mycol. **26**:419. 1929) by H. Sydow. In the original diagnosis the uredial stage was not mentioned. It has been found by the writer on the co-type collection: *Uredia* amphigenous, mainly hypophyllous, scattered or seriate, numerous, elliptic or oblong, 0.35–0.5 mm. long, at first covered by epidermis, at length ruptured by a longitudinal slit, pulverulent, yellowish; *uredospores* subglobose, globose or ovate, epispore about 1.5 μ thick, finely echinulate, hyaline, 14–19 x 12–13 μ; *pores* obscure.

Puccinia Cynodontis Desm.

On *Cynodon dactylon*. **Yunnan**: Kunming, *8384*.

Puccinia agrostidicola sp. nov.

FIGURE 4

On *Agrostis* sp. **Kansu**: Yungdun, Aug. 23, 1943, *W. L. Hsian*, *8404*, **type!**

Urediis hypophyllis, saepe etiam in vaginis culmisque evolutis, elongatis vel linearibus 0.5–1.5 mm. longis, sparsis, epidermide fissa cinctis, pulverulentis, flavo-brunneis; *uredosporis* globosis vel rarius ovoideis, subtiliter echinulatis, 24–33 x 23–30 μ, episporio 1.5–2 μ crasso, flavidis, *poris germinativis* 8–10 sparsis. *Teliis* urediis conformibus, pulvinatis, atris; *teliosporis* ellipsoideis vel ellipsoideo-oblongis, apice conico-attenuatis

vel rarius rotundatis, valde incrassatis (8.5–11 μ), medio leniter constrictis, basi plerumque attenuatis vel rotundatis, levibus, castaneo-brunneis, 36–56 x 17–27 μ, episporio 1.5–2 μ crasso; pedicello brunneolo, usque 46 μ longo; mesosporis paucis, ovatis vel ellipsoideis, apice magis incrassatis, 29–41 x 18–24 μ.

Puccinia coronata Corda

On *Rhamnus*, sp. **Yunnan**: Tungchuan, *4635*; Süanwei, *4453*; Hsiakwan, Tali, *4470*; Chichushan, Pinchuan, *4466*. On *R. leptophyllus*. **Szechuan**: Kwanhsien, *7118*, *7125*. On *Avena sativa*. **Yunnan**: Kunming, *7659*, *7930*; Sungming, *4641*; Tungchuan, *4620*, *4640*. On *Brachypodium sylvaticum*. **Yunnan**: Kunming, *7003*, *5033*, *7586*, *7608*. On *Calamagrostis* sp. **Szechuan**: Chengtu, *7544*. On *Bromus aspera*. **Yunnan**: Kunming, *7577*, *7624*, *7625*. On *Polypogon* sp. **Yunnan**: Kunming, *7762*. On *Polypogon luteolus*. **Yunnan**: Panchi, *7758*. On *Beckmannia Syzygachne*. **Yunnan**: Kunming, *7944*.

Puccinia invenusta Syd.

On *Phragmites Karka*. **Yunnan**: Kunming, *7000*, *7567*.

The uredospores and teliospores of the Yunnan fungus are slightly larger than those as originally described (uredospores 27–33 x 17–21 μ; teliospores 33–50 x 17–24 μ).

Puccinia Phragmitis (Schum.) Korn.

On *Phragmites communis*. **Yunnan**: Mengtze, *5092*; **Szechuan**: Chengtu, *4430*, *6829*.

Puccinia Eragrostidis-ferrugineae sp. nov.

FIGURE 10

On *Eragrostis ferruginea*. **Yunnan**: Kunming, December 20, 1939, *F. L. Tai*, *5024*, **type!** *5025*, *7731*.

Urediis amphigenis, plerumque hypophyllis, sparsis vel dense aggregatis, oblongis vel linearibus, 1–1.5 mm. longis, pulverulentis, aurantiacis; *uredosporis* subglobosis, ovoideis vel piriformibus, episporio 1.5–2 μ crasso, hyalino, echinulatis, 20–27 x 17–20 μ; *poris germinativis* sparsis 4–6 instructis. *Teliis* amphigenis, plerumque hypophyllis vel culmicolis, sparsis vel aggregatis, rotundatis, oblongis vel linearibus, confluentibus, 1–2 mm. longis, pulvinatis, brunneo-atris; *teliosporis* ellipsoideis vel late ellipsoideis, apice rotundatis vel obtuse acuminatis, basi rotundatis vel leniter attenuatis, apice leniter incrassatis (3–6 μ), episporio 1.5–2 μ crasso, medio non constrictis, levibus, castaneo-brunneis, 26–41 x 14–21 μ; *pedicello* hyalino, longiusculo, usque 113 μ longo.

This species differs from *Puccinia Eragrostidis* Petch in the larger uredia and telia, larger uredospores and teliospores; from *P. eragrostidicola* in the non-paraphysate and larger uredia, larger uredospores and slightly longer and narrower teliospores. The pedicel of the teliospore of the present fungus is also much longer.

Puccinia Festucae-ovinae sp. nov.

FIGURE 3

On *Festuca ovina*. **Yunnan**: Tali, May 21, 1940, *T. F. Yu* & *S. T. Chao*, *7834*, **type!**

Teliis amphigenis, plerumque epiphyllis, aggregatis vel sparsis, ellipticis vel oblongis, 0.5–0.8 mm. longis, pulvinatis, brunneo-atris; teliosporis ellipsoideis, rarius clavatis, apice plerumque rotundatis vel saepius acuminatis, leniter incrassatis (3–4 μ), basi plerumque rotundatis, saepius attenuatis, castaneo-brunneis, levibus, medio non vel leniter constrictis, 28–43 x 16–20 μ, episporio 1–1.5 μ crasso; *pedicello* hyalino, usque 57 μ longo, interdum lateraliter inserto.

This species is close to *Puccinia Crandallii*, but differs in the smaller thinner-walled and darker-colored teliospores, the apex of which is also thinner.

Puccinia Poae-sudeticae (Westend.) Jørstad

On *Poa annua*. **Szechuan**: Kwanhsien, *7117*, *7120*.

Puccinia graminis Pers.

On *Berberis pruinosa*. **Yunnan**: Kunming, *8163*; Chengkung, *4322*; Tungchuan, *4366*; Süanwei, *4321*. On *Mahonia Fortunei*. **Szechuan**: Omei-shan, *4432*. On *Triticum aestivum*. **Yunnan**: Anning, *4603*; Chengkiang, *4380*; Hsungtien, *4598*; Malung, *4602*; Lutien, *4611*; Tungchuan, *4599*; Jautung, *4596*; Süanwei, *4597*; Mengtze, *5345*. On *Hordeum vulgare*. **Yunnan**: Tsinling, *5383*; Hsungtien, *4607*; Jautung, *4606*; Kaiyuan, *5371*.

Puccinia glumarum (Schm.) Eriks. et Henn.

On *Triticum aestivum*. **Yunnan**: *5344*; Chengkung, *7394*; Tsinling, *7393*; Kunyang, *7392*; Yangling, *7283*; Chennan, *7282*; Chengkiang, *4378*; Hsungtien, *4594*; Sungming, *4163*; Jautung, *5384*; Tungchuan, *4592*; **Kweichow**: Meitan, *7670*; **Szechuan**: Chungking, *7397*. On *Hordeum vulgare*. **Yunnan**: Kunming, *5343*; Yuchi, *5378*; Lutien, *4604*; Tungchuan, *6202a*; Jautung, *4605*.

Puccinia rubigo-vera (DC.) Winter

On *Thalictrum dipterocarpum*. **Yunnan**: Kunming, *4390*. On *Agropyron semicostatum*. **Szechuan**: Kwanhsien, *7119*. On *Triticum aestivum*. **Yunnan**: Kunming, *4866a*; Lunan, *5326*; Tachwang, *5346*; I-Liang, *5361*; Mengtze, *5364*; Kaiyuan, *5178*; Hsungtien, *4595*; Chengkung, *4382*.

Puccinia Baryi (Berk. et Br.) Winter

On *Brachypodium sylvaticum*. **Yunnan**: Kunming, *4376*.

This rust is easily confused with *Puccinia glumarum* from which it is distinct in the paraphysate dark colored uredia, much shorter and slightly narrower teliospores, and uredospores with thicker and tinted walls.

Puccinia anomala Rostr.

On *Hordeum vulgare*. **Yunnan**: Kunming, *4612*; Chengkiang, *4384*; Sungming, *4613*; Tungchuan, *4616*; I-Liang, *5342a*; Lutien, *4606*; Tsinling, *5383*; Kaiyuan, *5371*.

Puccinia Arthraxonis (P. Henn.) Syd. et Butl.

On *Arthraxon* sp. **Yunnan**: Hsiakwan, Tali, *4766*.

Puccinia rufipes Diet.

On *Imperata cylindrica*. **Yunnan**: Tali, *7083*.

Puccinia Cacao MacAlpine

On *Rottboellia compressa*. **Yunnan**: Kunming, *7575*; **Szechuan**: Chengtu, *7614*.

Puccinia Phyllostachydis Kusano

On *Arundinaria* sp. **Yunnan**: Kunming, *5022*, *5021*, *5023*, *7190*. On *Bambusae*. **Yunnan**: Chichushan, Pinchuan, *8295*.

The writer in a previous publication (Sinensia **4**:113. 1933) erroneously referred a species of *Puccinia* on *Arundinaria* to *Puccinia Kusanoi* Diet. It should be *P. Phyllostachydis* Kusano.

Puccinia kwanhsienensis sp. nov.

FIGURE 7

On *Bambusa* sp. **Szechuan**: Kwanhsien, Oct. 11, 1936, *L. Ling*, *6852*, **type!**

Teliis amphigenis, rotundatis, ellipticis vel oblongis, sparsis vel aggregatis, pulvinatis, 0.35–0.8 mm. longis, atris; *teliosporis* ellipsoideis vel ellipsoideo-oblongis, apice rotundatis, truncatis vel acutiusculis, incrassatis (3–11 μ), basi leniter attenuatis, pallide castaneo-brunneis, levibus, medio non vel leniter constrictis, 37–57 x 15–23 μ, episporio 1.5–2.5 μ crasso; *pedicello* brunneolo, sporam subaequante; paraphysibus capitatis vel clavatis, brunneolis, 54–60 μ longis, apice 16–19 μ crassis; *uredosporis* immixtis globosis, 18–20 μ diam., flavo-brunneis, echinulatis, episporio ca. 2.8 μ crasso, *poris germinativis* 4 sparsis instructis.

ON CYPERACEAE

Puccinia Romagnoliana Maire et Sacc.

On *Cyperus difformis*. **Yunnan**: I-Liang, *7810*. On *C. rotundus*. **Yunnan**: Wenshan, *5745*. On *C.* sp. **Yunnan**: Chaopa, *7811*.

Uredia hypophyllous and caulicolous, on black elongated spots, scattered or gregarious, roundish, elliptic or oblong, 0.5–2 mm. long, at first bullate, covered by epidermis, then ruptured by a longitudinal slit, pulverulent, cinnamon brown; *uredospores* subglobose or ovoid, epispore 2–3 μ thick, pale cinnamon brown, prominently echinulate, 21–30–(34) x 16–23 μ; *pores* 2 approximately equatorial. *Telia* similar, oblong or linear, often confluent into groups, 1–3 mm. long, pulvinate, brownish black; *teliospores* fusoid-oblong or clavate, obtusely acuminate, rounded or rarely truncate at the apex, apex thickened (4–11 μ), narrowed below, epispore 1–1.5 μ thick, chestnut brown at apex, paler below, slightly constricted at septum, 36–67 x 13–20 μ, smooth; *pedicel* brownish, short; *paraphyses* numerous subepidermal between telia; *mesospores* present.

The collections listed above differ from *P. Cyperi* in the thicker-walled uredospores with only 2 germ pores; from *P. canaliculata* and *Uredo cypericola* in the thicker-walled and larger uredospores; from *P. Cyperi-tageti-formis* Kern and *P. philippinensis* in the larger uredospores and teliospores,

and from *Uredo Cyperi-tagetiformis* P. Henn. in the smaller uredospores. The characters of the forms studied agree better with the description of *P. Romagnoliana* than that of the other species.

Puccinia Juncelli Diet.

On *Cyperus serotinus*. **Yunnan**: Kunming, *7809*.

Telia hypophyllous, elliptic, oblong or linear, 0.35–2.5 mm. long, covered by epidermis, black; *teliospores* oblong, clavate, rarely ellipsoid, rounded, conical or rarely truncate at apex, rounded or usually narrowed at base, epispore 1–1.5 μ thick, apex thickened (4–7 μ), not or slightly constricted at septum, chestnut brown at apex, paler below, 43–63 x 16–23 μ; *pedicel* about half as long as the spore, brownish or yellowish brown; *mesospores* present. Intermixed *uredospores* ovoid, ellipsoid or globoid, epispore thin, about 1.5 μ thick, brownish, finely and sparingly echinulate, 29–40 x 22–28 μ; *pores* 4 equatorial.

Puccinia liberta Kern

On *Eleocharis tuberosus*. **Fukien**: Shaowu, *8294*.

Puccinia constata Syd.

On *Carex baccans*. **Yunnan**: Kunming, *7598*, *7814*.

Puccinia Yokokurae P. Henn.

FIGURE 23

On *Carex heterolepis*. **Hopei**: Peiping, *8432*.

Uredia hypophyllous, scattered or subgregarious, roundish or elliptic, 0.35–0.5 mm. long, cinnamon brown, pulverulent; *uredospores* ovoid, globoid or ellipsoid, finely and sparingly echinulate, epispore 2–2.5 μ thick, cinnamon brown or paler, 20–27 x 16–21 μ; *pores* 2–3 equatorial.

Telia hypophyllous, scattered or subgregarious, roundish or linear, 0.35–1 mm. long, pulvinate, black; *teliospores* oblong-clavate or clavate, apex rounded, truncate or acuminate, thickened (8.5–11 μ), chestnut-brown above, paler and rounded or usually narrowed below, smooth, 1.5–2 μ thick at sides, (36)–42–53–(61) x 16–21 μ, usually constricted at septum; *pedicel* brownish, usually shorter than the spore; *mesospores* present.

The measurements of the spores and other characters of this form agree well with the description of *P. Yokokurae*. Unfortunately, in the original description of the latter species, the thickness of the walls, and number and position of the germ pores of the uredospore, which are important characters in the identification of the rust fungi on *Carex*, are not mentioned.

Puccinia Caricis (Schum.) Rebent.

On *Carex cruciata*. **Szechuan**: Kwanhsien, *7127*.

ON JUNCACEAE

Puccinia obscura Schroet.

On *Luzula multiflora*. **Yunnan**: Tali, *7100*.

ON LILIACEAE

Puccinia pachycephala Diet.

On *Veratrum* sp. **Hunan**: Hengshan, *4756.*

The teliospores of the present plant measure 40–67 x 18–24 μ, narrower than those given in the diagnosis of *P. pachycephala.*

Puccinia veratricola sp. nov.

FIGURE 20

On *Veratrum taliense.* **Yunnan**: Changshan, Tali, Aug. 26, 1938, *H. S. Yao, 5046,* **type!**

Uredíis amphigenis, plerumque hypophyllis, rotundatis vel ellipticis, 0.35–0.5 mm. longis, diutius epidermide tectis, dein ea longitudinaliter fissa cinctis, pulverulentis, flavidis; uredosporis subglobosis, globosis vel ovoideis rarius ellipsoideis, echinulatis, flavidis vel hyalinis, 20–26 x 17–19 μ, episporio 2–2.8 μ crasso, *poris germinativis* indistinctis. *Teliis* conformibus, diutius epidermide tectis, atris; *teliosporis* oblongis vel clavatis, apice rotundatis, truncatis vel conico-attenuatis, incrassatis (3–6 μ), basi rotundatis vel attenuatis, medio non vel leniter constrictis, levibus, flavo-brunneis, apice obscurioribus, 41–49 x 16–17 μ, episporio 1–1.5 μ crasso; *pedicello* brevi, brunneolo.

Puccinia Hemerocallidis Thuem.

On *Hemerocallis* sp. **Yunnan**: *6878, 7580, 8048*; Tali, *4546, 5045.*

The Chinese forms have smaller teliospores (31–57 x 14–20 μ) and no paraphyses. They might not be identical with *P. Hemerocallidis.*

Puccinia Porri (Sow.) Winter

On *Allium fistulosum.* **Yunnan**: Kunming, *4836, 4585, 5179*; Chengkung, *4387, 4861.* On *A. sativum.* **Yunnan**: Kunming, *4586, 4587, 5185.*

Puccinia ferruginea Lev.

On *Smilax longipes.* **Yunnan**: Cheli, *7024.* On *S.* sp. **Kweichow**: Meitan, *7934.* On *Heterosmilax Gaudichaudiana.* **Fukien**: Yungan, *7959.*

According to the Sydows (Monogr. Ured. **1**:635) *P. Smilacis-chinae* is distinct from *P. ferruginea* in the smaller and somewhat less compact telia, smaller, lighter-colored teliospores and shorter and hyaline pedicel. A study of specimens from different parts of China shows that the differences as pointed out by the Sydows do not hold good. For instance, the collection no. *7934* has longer teliospores (54–84 x 16–24 μ), but the telia are only 0.5–0.8 mm. in diameter and the teliospores are yellowish in color with pedicels up to 122 μ long. The size of the telia and the teliospores of the collection no. *7024* corresponds closely with that of *P. Smilacis-chinae*, but the color of the teliospore varies from yellowish to brownish yellow, and the pedicels are yellowish, up to 102 μ long.

Pycnial and aecial stages were found by Arthur and Cummins (Philippine Jour. Sci. **59**:446. 1936) on a collection identified by them as *P. Smilacis-chinae* from the Philippines. Those stages were considered by them to belong with this species. The *Aecidium* so far collected on *Smilax* in China is *A. Smilacis* Schw.

Puccinia Smilacis Schw.

On *Smilax* sp. **Hunan**: Yolushan, Changsha, *4573*; Hengshan, *4476*, *4475*, *4478*; **Yunnan**: Kunming, *4840*.

Puccinia Smilacis-sempervirentis Wang (Bull. Mus. Nat. Hist. Nat. (Paris) ser. 2, **10**:523. 1938) differs from *P. Smilacis* mainly in the amphigenous and blackish-brown telia which are aggregated in groups. On the collections nos. *4573* and *4478* listed above, the telia, although hypophyllous, often aggregate in groups (1.5–2.5 mm. in diam.), and the telia of all the collections the writer studied are dark chestnut brown in color, not black as described in the original diagnosis. *P. Smilacis-sempervirentis* might be identical with *P. Smilacis*.

ON IRIDACEAE

Puccinia Iridis (DC.) Wallr.

On *Iris ensata*. **Kansu**: Wuwei, *8391*; Chang-I, *8418*; Yungdun, *8410*.

ON ZINGIBERACEAE

Puccinia Roscoeae Barcl.

FIGURE 26

On *Roscoea intermedia*. **Yunnan**: Kunming, *7964*. On *Camptandra yunnanensis*. **Yunnan**: Chichushan, Pinchuan, *5066*.

ON POLYGONACEAE

Puccinia Muehlenbeckiae (Cooke) Syd.

FIGURE 27

On *Muehlenbeckia platycladia*. **Kiangsu**: Nanking, *8433*.

Puccinia Acetosae (Schum.) Korn.

On *Rumex dentatus*. **Yunnan**: Kunming, *6081*, *7836*.

Puccinia punctiformis Dietel et Holway

On *Rumex nepalensis*. **Yunnan**: Kunming, *4397*; Chengkung, *7630*. On *R. crispus*. **Szechuan**: Kwanhsien, *7128*.

Eight species of *Puccinia* have been reported on the genus *Polygonum* from China: *P. mamillata* Schroet., *P. Fagopyri*, *P. congesta*, *P. Bistortae*, *P. Polygoni-amphibii*, *P. Polygoni-lapathifolii*, *P. nitidula* and *P. calumnata*. An examination of the type specimen of *P. Polygoni-lapathifolii*, made available through the kindness of Dr. T. N. Liou, shows that it is identical with *P. Polygoni-Wejrichii* Miyake.

More than 20 species of *Puccinia* have been described on *Polygonum*. Only 17 of these species seem to be valid. In the course of studying the rust collections on *Polygonum* from the province of Yunnan an attempt has been made by the writer to study all the species of *Puccinia* so far described on that genus. Unfortunately authentic specimens of several of these spe-

cies are not available for study. In this paper 7 species of *Puccinia* on *Polygonum* are recorded; 3 are described as new.

Puccinia congesta B. et Br.

On *Polygonum Dielsii*. **Yunnan**: Kunming, *5008*.

Telia aggregated into small roundish groups on brown spots, pulvinate, roundish, sometimes confluent, cinnamon brown, minute, about 0.3 mm. in diameter, the groups 1.5–3 mm. in diameter; *teliospores* ellipsoid-oblong or oblong, thin-walled, not thickened at apex, smooth, brownish, constricted at septum, rounded at apex, rounded or usually tapering towards the base, germinating on maturity, 37–50 x 16–21 μ (43 x 19 μ); *pedicel* persistent, hyaline, up to 77 μ long.

Petch suggested that *P. congesta* might be identical with *P. Solmsii* (Ann. Roy. Bot. Gard. Peradeniya **5**:233. 1912). Specimens collected at Kunming have been compared with those of Java (*P. Solmsii*), Raciborski *63*, and India (3 collections, of which two are labelled *P. congesta* and one *P. Solmsii*), and found to be the same. No uredia have been observed on any of the specimens. In the description of *P. consimilis* P. Henn., a synonym of *P. Solmsii*, uredospores have been described ("18–26 x 15–24, levibus, castaneis"). According to the size and other characters of the uredospores in that description the supposed uredospores are evidently cells of the teliospore which have fallen apart as has already been pointed out by the Sydows (Mon. Ured. **1**:568. 1904). In 1912 Petch on redescribing *P. congesta* gave, however, description of a uredial stage which was not mentioned in the original diagnosis nor found in all the collections including one from Ceylon the present writer studied. It is hoped that some local mycologist in Ceylon will re-examine the specimens studied by Petch and clear up the question of the uredial stage.

Puccinia Polygoni-amphibii Pers.

On *Polygonum cuspidatum*. **Yunnan**: Kunming, *5014*; **Hunan**: Hengshan, *5013*, *5016*; **Szechuan**: Omeishan, *6834*; **Chekiang**: Hangchow, Univ. Nanking, Path. Herb. no. *2421*. On *P. multiflorum*. **Yunnan**: Kunming, *5009*, *5021*.

The number and position of the pores of the uredospore of the above collections are variable. Thus, the uredospores of collections nos. *5013*, *5014*, *5016* (on *Polygonum cuspidatum*), *5009* and *5002* (on *Polygonum multiflorum*) have 2 to 4 equatorial pores. Only two superequatorial pores are present in the uredospores of the collection Univ. Nanking no. *2421*, while collection no. *6834* has uredospores with 2 to 4 superequatorial or equatorial pores.

Puccinia polygonicola sp. nov.

FIGURE 15

On *Polygonum chinense*. **Hunan**: Hengshan, November 16, 1937, *C. C. Cheo*, *5004*, **type!** On *P. nepalense*. **Yunnan**: Kunming, *5000*, *5001*,

7596; **Szechuan**: Kwanhsien, *6314*. On *P. caespitosum*. **Hunan**: Hengshan, *5003*, *5013*; **Yunnan**: Lunan, *7761*.

Urediis amphigenis, plerumque hypophyllis, sparsis vel aggregatis, rotundatis, 1–1.5 mm. diam., pulverulentis, cinnamomeo-brunneis; *uredosporis* subglobosis, ovoideis, rarius ellipsoideis echinulatis, pallide cinnamomeo-brunneis, 20–30 x 16–23 μ, episporio 1.5–2.0 μ crasso, *poris germinativis* 2–3 in parte basali praeditis.

Teliis amphigenis, plerumque hypophyllis, sparsis vel dense aggregatis, rotundatis vel ellipticis, 0.5–1.5 mm. diam., confluentibus vel circinatim dispositis, pulvinatis, atris; *teliosporis* oblongis vel clavatis, apice valde incrassatis (6–10 μ), rotundatis vel truncatis rarius acuminatis, basi plerumque attenuatis, levibus, castaneo-brunneis, medio non vel parum constrictis, 30–53 x 15–24 μ; episporio 1.5–2 μ crasso; *pedicello* hyalino, brevi.

This species is close to *Puccinia yunnanensis* but differs in the larger uredia and telia, and longer and broader teliospores which are much thickened at apex (6–10 μ).

Puccinia yunnanensis sp. nov.

FIGURE 16

On *Polygonum cymosum*. **Yunnan**: Hsiakwan, Tali, August 21, 1938, *C. C. Cheo* and *H. S. Yao*, *5005*, **type!** Kunming, *5291*, *7686*.

Urediis hypophyllis, sparsis vel gregariis, rotundatis, ca. 0.5 mm. diam., pulverulentis, cinnamomeo-brunneis; *uredosporis* subglobosis vel ellipsoideis, echinulatis, pallide cinnamomeo-brunneis, 23–29 x 16–20 μ, episporio 1.5–2 μ crasso, *poris germinativis* 1 vel 2 juxta pedicelli insertionem praeditis. *Teliis* hypophyllis, sparsis vel gregariis 0.35–0.5 mm. diam. compactis, atris; *teliosporis* plerumque oblongis vel oblongo-clavatis, apice parum incrassatis (3–7 μ), rotundatis vel truncatis, medio non vel leniter constrictis, basi rotundatis vel attenuatis, castaneo-brunneis, levibus, 23–47 x 16–20 μ, episporio 1.5–2.5 μ crasso; *pedicello* hyalino, brevi.

Puccinia taliensis sp. nov.

FIGURE 12

On *Polygonum paleaceum* var. *pubifolium*. **Yunnan**: Changshan, Tali, August 26, 1938, *C. C. Cheo*, *5018*, **type!** *5019*, *5020*, *4568*. On *P. viviparum*. **Yunnan**: Changshan, Tali, *5017*.

Urediis amphigenis, plerumque hypophyllis, aggregatis vel sparsis, rotundatis, 0.5–0.8 mm. diam., pulverulentis, cinnamomeo-brunneis; *uredosporis* subglobosis vel globosis, echinulatis, cinnamomeo-brunneis, 21–24 x 20–23 μ, episporio 3–3.6 μ crasso, *poris germ.* 4–5 sparsis praeditis.

Teliis amphigenis, plerumque hypophyllis, sparsis vel gregariis, rotundatis, subpulverulentis, 0.25–0.5 mm. diam., confluentibus, atro-brunneis; *teliosporis* ellipsoideis vel ellipsoideis-oblongis, apice rotundatis vel acuminatis, incrassatis (6–7 μ), basi rotundatis vel attenuatis, medio non vel parum constrictis, castaneo-brunneis, levibus vel minutissime verrucosis, 30–51 x 19–26 μ (36 x 20 μ); episporio 2–3 μ crasso; *pedicello* hyalino, persistente, usque 78 μ longo.

This species is close to *P. sachalinensis* Pat. et Har., but differs in the sometimes minutely verrucose, longer and broader teliospores with less thickened apex.

Puccinia Fagopyri Barcl.

On *Polygonum cymosum*. **Yunnan**: Chichushan, Pinchuan, *5002*; **Hunan**: Hengshan, *5011*, *5015*. On *P. capitatum*. **Yunnan**: Hsiakwan, Tali, *4999*.

Puccinia Polygoni-Wejrichii Miyake

On *Polygonum lapathifolium*. **Shantung**: Muping, August 21, 1933, *T. N. Liou* and *K. M. Liou*, *1274*, **type** of *P. Polygoni-lapathifolii* Liou et Wang.

The type of *P. Polygoni-lapathifolii* of Liou and Wang has been studied again by the present writer, and is doubtless identical with *P. Polygoni-Wejrichii* Miyake, published in 1931, in spite of the fact that the type of the latter has not been seen.

ON CARYOPHYLLACEAE

Puccinia Behenis Otth.

On *Cucubalus baccifer*. **Yunnan**: Kunming, *5050*.

Puccinia Arenariae (Schum.) Wint.

On *Stellaria saxatilis*. **Yunnan**: Kunming, *7832*. On *S. paniculata*. **Yunnan**: Shueili, *5058*.

Puccinia Stellariae Liou and Wang described from North China is apparently identical with this species.

ON RANUNCULACEAE

Puccinia clematidicola sp. nov.

FIGURE 14

On *Clematis connata*. **Yunnan**: Chichushan, Pinchuan, Sept. 11, 1938, *H. S. Yao*, *4540*, **type!**

Teliis epiphyllis, solitariis vel circinatim dispositis, rotundatis, 0.25–1 mm. diam., primo tectis epidermide, demum fissa cinctis, pulverulentis, castaneo-brunneis; *teliosporis* ellipsoideis vel fusoideo-oblongis, apice attenuatis, papilla majuscula hyalina auctis, basi rotundatis vel attenuatis, medio non constrictis, 41–57 x 20–26 μ, castaneo-brunneis, levibus, episporio 2–3 μ crasso; *pedicello* hyalino, fragili, spora breviore, subinde lateraliter inserto.

Puccinia Wattiana Barcl.

FIGURE 22

On *Clematis Peterae*. **Yunnan**: Kunming, *4838*. On *C.* sp. **Yunnan**: Wenshan, *4374*, *4439*.

Telia amphigenous, chiefly hypophyllous, densely gregarious into small groups (3–4 mm. in diam.), usually circinately arranged, roundish, 0.3–0.5 mm. in diameter, often confluent, at first covered by epidermis, finally ruptured, compact, chestnut brown; *teliospores* ovate, broadly ovate or oblong, rounded or slightly attenuated at both ends, flat hyaline papillae over the pores, not thickened at apex, not or slightly constricted at septum, 2 kinds

of *spores*: thin-walled spores 1.5–2 μ thick, cinnamon-brown or paler, thick-walled spores 2–3 μ thick, chestnut brown, pore of the upper cell apical or slightly depressed, that of the lower lateral or near the hilum, 31–43 x 19–24 μ; *pedicel* fragile usually short, sometimes as long as the spore; spores germinating immediately; *mesospores* numerous, various in shape, 27–37 x 14–19 μ. As far as description is concerned *Puccinia exhausta* Diet. does not seem to differ from this species.

ON BERBERIDACEAE

Puccinia Epimedii (P. Henn.) Miyabe et Ito

On *Epimedium* sp. **Szechuan**: Omeishan, *6835*; **Shensi**: Linkiang, *4805*; Chengku, *4306*.

ON LAURACEAE

Puccinia Cinnamomi sp. nov.

FIGURE 11

On *Cinnamomum* sp. **Szechuan**: Omeishan, Aug. 1, 1936, *L. Ling*, *6839*, **type!**

Teliis amphigenis, plerumque hypophyllis, sparsis vel subgregariis, rotundatis, 1–1.5 mm. diam., pulverulentis, cinnamomeo-brunneis vel castaneo-brunneis; *teliosporis* fusiformibus vel longe clavatis, apice rotundatis vel attenuatis, leniter incrassatis (3–4 μ), basi attenuatis, medio non vel leniter constrictis, levibus, castaneo-brunneis vel cinnamomeo-brunneis, 60–110 x 12–20 μ, episporio 1.5–2 μ crasso; *pedicello* hyalino, fragili, gracili (4 μ lato), plerumque brevi, subinde sporum aequante.

In the telia of the present fungus there are dispersed here and there minute, hard, black and roundish galls (0.35–0.5 mm. in diam.). The teliospores are produced among these galls. There occur two kinds of teliospores: the thick-walled ones are shorter and narrower (60–90 x 12–19 μ), while the thin-walled ones are longer and broader (66–111 x 14–20 μ).

ON ROSACEAE

Puccinia Pruni-persicae Hori

On *Prunus persica*. **Hunan**: Hengshan, *4722*, *4751*.

ON LEGUMINOSAE

Puccinia Glycyrhizae sp. nov.

FIGURE 17

On *Glycyrhiza aspera*. **Kansu**: Tungwei, June 29, 1943, *W. L. Hsian*, *8402*, **type!**

Urediis amphigenis, plerumque hypophyllis, totum folium occupantibus, rotundatis, 0.25–0.5 mm. diam., pulverulentis, cinnamomeo-brunneis; *uredosporis* plerumque globosis, subglobosis vel ovatis, brunneolis, subtiliter echinulatis, 26–31 x 21–24 μ, episporio 1.5–2 μ crasso, *poris germ.* 2–3 aequatorialibus. *Teliis* conformibus, castaneo-brunneis; *teliosporis* ovatis vel late ovatis, utrinque rotundatis, basi rarius leniter attenuatis, dense verruculosis, cinnamomeo-brunneis, medio non vel leniter constrictis, 30–37 x 19–24 μ,

epispório 2.5–3.0 μ crasso; *pedicello* fragili, hyalino, brevi, plerumque lateraliter inserto; *mesosporis* paucis immixtis.

ON BALSAMINACEAE

Puccinia Impatientis-uliginosae sp. nov.

FIGURE 19

On *Impatiens uliginosa*. **Yunnan**: Puchi, Kunming, October 25, 1941, *F. L. Tai, 7785*, **type!** *7826*.

Urediis amphigenis, plerumque hypophyllis, rotundatis, sparsis vel gregariis, 0.5–1 mm. diam., pulverulentis, cinnamomeo-brunneis; *uredosporis* globosis vel ovatis, rarius ellipsoideis, echinulatis, pallide cinnamomeo-brunneis, 20–30 x 18–20 μ, episporio 1.5–2 μ crasso, *poris germinativis* 2–4 aequatorialibus. *Teliis* conformibus, subpulverulentis, brunneo-atris; *teliosporis* plerumque ellipsoideis vel oblongis, apice attenuatis vel rotundatis, papilla majuscula brunneola auctis, basi rotundatis subinde attenuatis, levibus, castaneo-brunneis, 31–51 x 17–23 μ, episporio 1.5–2.5 μ crasso; *pedicello* hyalino, brevi; *mesosporis* paucis immixtis.

This fungus is close to *Puccinia argentata*, but is distinct in the larger, darker-colored and thicker-walled uredospores and teliospores. It also differs from *P. Komarovi* in the 2 to 4 equatorial pores of the uredospore and longer teliospores.

ON MALVACEAE

Puccinia Abutili Berk. et Br.

On *Abutilon Gebauerianum* ? **Yunnan**: Yuankiang, *6464*, *4500*; Shihping, *6687*.

Puccinia heterospora Berk. et Curt.

On *Abutilon avicennae* ? **Yunnan**: Kaiyuan, *5065*.

ON VIOLACEAE

Puccinia Violae (Schum.) DC.

On *Viola Patrinii*. **Szechuan**: Kwanhsien, *7122*. On *V. betonicifolia*. **Szechuan**: Kwanhsien, *7116*; Omeishan, *7545*.

ON ONAGRACEAE

Puccinia Circaeae Pers.

On *Circaea imaicola*. **Yunnan**: Kunming, *5044*.

ON UMBELLIFERAE

Puccinia Oenanthes (Diet.) Miyake

On *Oenanthe stolonifera*. **Szechuan**: Chengtu, *6851*.

ON PRIMULACEAE

Puccinia Dieteliana Syd.

On *Lysimachia clethroides*. **Hunan**: Hengshan, *4754*, *4755*. On *L.* sp. **Szechuan**: Omeishan, *6837*.

ON GENTIANACEAE

Puccinia Swertiae Wint.

On *Swertia* sp. **Yunnan**: Tali, *4645*.

ON CONVOLVULACEAE

Puccinia Convolvuli (Pers.) Cast.

On *Calystegia hederacea*. **Yunnan**: Kunming, *8434*.

ON LABIATAE

Puccinia Menthae Pers.

On *Mentha arvensis*. **Yunnan**: Lunan, *7256*; Sungming, *4394*; Kunming, *5048*.

Puccinia Leucadis Syd.

On *Leucas ciliata*. **Yunnan**: Kunming, *7963*, *8149*.

Puccinia leucophaea Syd. et Butl.

FIGURE 13

On *Colquhounia coccinea*. **Yunnan**: Changshan, Tali, *4445*; Hsiakwan, *4419*; Chichushan, Pinchuan, *4440*, *5071*, *5072*.

Pycnia epiphyllous, gregarious in the center of spots, often surrounded by aecia, 80–180 μ in diameter. *Aecia* amphigenous, mainly epiphyllous, on yellow orbicular spots (2–4 mm. in diam.), gregarious, cylindrical, 0.5–1 mm. long, 260–360 μ wide; *peridial cells* subrhomboid or oblong, 31–45 x 21–26 μ, exterior walls striate, 6–8.6 μ wide, interior 3–4 μ wide, verrucose; *aeciospores* globose or ovate, coarsely verrucose, yellowish or subhyaline, epispore 2–3 μ thick, 21–30 x 18–26 μ. *Uredia* amphigenous, mainly hypophyllous, scattered or subgregarious, roundish, 0.2–0.5 mm. in diameter, pulverulent, cinnamon brown; *uredospores* globose, subglobose or rarely ovate, sparingly echinulate, pale cinnamon brown, epispore 1–1.5 μ thick, 23–27 x 18–24 μ; *pores* 2–3 scattered. *Telia* similar, chestnut brown; *teliospores* of two types: thin-walled ones, the prevalent type, various in shape, usually ellipsoid or oblong, epispore 1–1.5 μ thick, pale cinnamon brown, 27–56 x 18–27 μ, thick-walled ones ellipsoid, epispore 3–4 μ thick, chestnut brown, 33–46 x 21–27 μ, smooth, yellowish conic or hemispheric papillae over the pores, pore of the upper cell apical, that of the lower at the septum; *pedicel* hyaline, fragile, usually short, sometimes 1–2 times the length of the spore.

The uredospores of the Yunnan fungus are smaller and the teliospores much narrower than those originally described for *P. leucophaea*.

ON ACANTHACEAE

Puccinia Shiraiana Syd.

On *Justicia xerobatica*. **Yunnan**: Kunming, *4389*, *7946*. On *J. procumbens*. **Fukien**: Yungan, *7503*.

Three species of *Puccinia* have been described on *Justicia*: *P. Thwaitesii*, *P. Shiraiana* and *P. peraffinis*. According to the description *P. Thwaitesii* is distinct from the other two in the large size of the teliospores and the absence of mesospores. *P. peraffinis*, according to Sydow, differs from *P. Shiraiana* mainly in the slightly thickened apex and distinct constriction at the septum. The teliospore of Chinese forms of *Puccinia* on the genus *Justicia* so far studied by the writer all have a slightly thickened apex and are not or slightly constricted at the septum. As the authentic specimens of *P. peraffinis* are not available for study, it is difficult to decide whether to refer these Chinese plants to *P. peraffinis* or to *P. Shiraiana*; the apex of the latter is stated in the original diagnosis to be not thickened. The writer is inclined to the opinion that when the type of *P. peraffinis* is re-examined and compared with *P. Shiraiana*, it will be found to be identical.

ON RUBIACEAE

Puccinia punctata Link

On *Galium* sp. **Yunnan**: Kunming, *4442*.

ON VALERIANACEAE

Puccinia Patrinae P. Henn.

On *Patrina* sp. **Hunan**: Hengshan, *4745*.

ON COMPOSITAE

Puccinia Helianthi Schw.

On *Helianthus annuus*. **Yunnan**: Chengkung, *4388*.

Puccinia Saussureae-ussuriensis Liou et Wang

FIGURE 21

On *Saussurea* sp. **Hunan**: Hengshan, *4523*.

Telia hypophyllous on orbicular spots with ashy centers (1.5–2.5 mm. in diam.), roundish, minute, 0.35–0.5 mm. in diameter, gregarious in scattered small groups (1.5–2 mm. in diam.), pulvinate, dark brown; *teliospores* ellipsoid, oblong or clavate, acuminate or usually rounded, rarely truncate at apex, rounded or attenuated below, apex not or slightly thickened (3–6 μ), 1–1.5 μ thick at sides, smooth, slightly constricted at septum, often 2 or 3 septate, yellowish or subhyaline, pore of the upper cell apical or depressed, of the lower at the septum, 40–63 x 16–20 μ, germinating *in situ*; *pedicel* persistent, hyaline, as long as the spore but usually shorter, rarely laterally attached; *mesospores* few, present.

This species differs from *P. Saussureae* Thuem., *P. Ivantzkiae* Tranzs. and *P. Saussureae-alpinae* Liro in the smooth and larger spores. It is very close to *P. Vomica* Thuem. in the size of the spores, but differs in that the telia of the latter are larger (2–4 mm.) and solitary, while those of the present plant are aggregated and only 0.35–0.5 mm. in diameter. Besides, the apex of the teliospore of the Chinese plant is less thickened. It, however,

corresponds very well with the description of *P. Saussureae-ussuriensis* Liou et Wang (Contr. Inst. Bot. Nat. Acad. Peiping **3**:447. 1938) except that the *Caeoma* stage which they reported is not present in the Hunan collections.

Puccinia Millefolii Fckl.

On *Artemisia japonica*. **Yunnan**: Kunming, *4525*. On *A. vulgaris*. **Yunnan**: Kunming, *4373*.

The plants of these collections fit well with *P. ferruginosa* in the measurements of the spores etc., but *P. ferruginosa* does not seem to differ essentially from *P. artemisiicola* and *P. Millefolii*. The present writer follows Teng (Sinensia **8**:276. 1937) in considering *P. ferruginosa* as a synonym of *P. Millefolii*. *P. phragmoides* Liou et Wang (Contr. Inst. Bot. Nat. Acad. Peiping **1**:158. 1934) which is said to be distinct from *P. artemisiicola* only in the presence of 3 or 4 celled teliospores should also be considered as synonymous.

Puccinia absinthii DC.

On *Artemisia mongolica*. **Yunnan**: Kunming, *8154*. On *A. dubia*. **Yunnan**: Kunming, *8155*. On *A. japonica*. **Hunan**: Huanhsien, *4803*.

Puccinia Schirajewskii Tranzsch.

On *Serratula* sp. **Kansu**: Wuwei, *8403*.

Puccinia Carthami Corda

On *Carthamus tinctorius*. **Kansu**: Chang-I, *8435*.

Puccinia minussensis Thuem.

On *Lactuca indica*. **Yunnan**: Kunming, *7922*, *7948*; Chengkung, *7632*; **Szechuan**: Chengtu, *8488*; **Kansu**: Tungwei, *8401*.

It seems that *P. lactucicola* Miura should be reduced as a synonym of *P. minussensis*. It was stated that the former is very close to *P. hemisphericum*, a synonym of *P. minussensis*, except that the pore of the lower cell is situated ⅔–¾ from the septum ! (Ann. Mycol. **11**:96. 1913).

Puccinia Lactucae-repentis Miyabe et Miyake

On *Lactuca versicolor*. **Yunnan**: Chengkung, *7633*. On *L.* sp. **Szechuan**: Chengtu, *8423*.

Pycnia amphigenous, scattered. *Aecia* amphigenous, chiefly hypophyllous, isolated or gregarious (2–10), shortly cupulate, margin straight, lacerate, white, 230–380 μ in diameter; *peridial cells* rhomboid or oblong, 24–36 x 15–19 μ, exterior walls 4–6 μ thick, striate, interior 1.5–2.8 μ thick, minutely and densely verrucose; *aeciospores* subglobose or ellipsoid, angular, densely verruculose, epispore 1–1.5 μ thick, hyaline, 13–26 x 11–18 μ. *Uredia* amphigenous, mostly hypophyllous, scattered or subgregarious, 0.25–0.5 mm. in diameter, roundish, pulverulent, cinnamon brown; *uredospores* subglobose or ovoid, epispore 1.5–2 μ thick, pale cinnamon brown,

finely echinulate, 18–24 x 17–20 μ; *pores* 3–4 scattered, not covered by a swollen cap. *Telia* similar roundish, 0.35–1 mm. in diameter, sometimes confluent, pulverulent, chestnut brown; *teliospores* broadly ovate or ellipsoid, rarely subglobose, not or hardly constricted at septum, apex not thickened, rounded at both ends, epispore 1–1.5 μ thick, chestnut brown, 26–37 x 20–24–(29) μ, minutely verruculose, sometimes smooth near the base, pore of the upper cell apical or much depressed, that of the lower near the septum or depressed; *pedicel* short, hyaline, fragile, usually laterally attached.

The plants of the collections listed above correspond closely with the decription of *Puccinia Lactucae-repentis* except that the present plants have a uredial stage, and slightly broader teliospores. The writer has compared these Chinese forms with one from Japan (On *Lactuca repens*, Zenibako, Shiribeshi, Japan, Oct. 9, 1924, *Naohide Hiratsuka*, no. *561*, *ex* Herbarium Hiratsuka) and found they are the same except that the uredial stage is lacking in the collection from Japan. The teliospores of the Japanese plant are about of the same size as those of the Chinese forms, measuring 26–34 x 17–23 μ. The omission of the uredial stage in the Japanese form may be ascribed to the different growth conditions in Japan as in the case of *Puccinia Acetosae* which has its uredial stage suppressed in northern Europe or at high altitudes.

Puccinia Lactucae-debilis Diet.

On *Lactuca debilis*. **Hopei**: Paoting, *8422*.

Only the aecial stage is present. The measurements of the aeciospores and other characters fit well with the description of *Aecidium Lactucae-debilis*, but it could be referred to *Puccinia Lactucae-debilis* just as well.

UREDINALES IMPERFECTI

AECIDIUM Pers.

Aecidium Smilacis Schw.

On *Smilax china*. **Kiangsu**: I-Hsin, *8438*.

Aecidium Dispori Diet.

On *Disporum pullum*. **Szechuan**: Kwanhsien, *8443*.

Aecidium Mori Barcl.

On *Morus alba*. **Yunnan**: Kunming, *4307*; Chengkiang, *4308*; Mengtze, *4309*. On *M. australis*. **Yunnan**: Kunming, *7921*.

Aecidium orbiculare Barcl.

On *Clematis* sp. **Yunnan**: Süanwei, *4391*.

Aecia on stem causing cylindrical swelling, gregarious, cupulate or short cylindrical, up to 1 mm. long, 0.5–0.7 mm. wide, yellowish, margin lobed, revolute; *peridial cells* rhomboid, outer walls 4–6 μ thick, striate, inner about *2* μ thick, coarsely verrucose; *aeciospores* globose, subglobose or

ovate, epispore 1–1.5 μ thick, hyaline, minutely and densely verrucose, 16–21 x 14–17 μ.

Aecidium Machili P. Henn.

On *Machilus Bournei*. **Szechuan**: Kwanhsien, *6843*, *7124*.

Aecidium Pourthiaeae Syd.

On *Photinia* sp. **Hunan**: Hengshan, *4310*.

This species differs from *Gymnosporangium japonicum* in the lighter colored and thin-walled aeciospores and different peridial cells. Tanaka and Arthur considered this species as a synonym of *G. japonicum*. The writer agrees with the Sydows in considering it as distinct.

Aecidium Campylotropidis sp. nov.

On *Campylotropis polyantha*. **Yunnan**: Kunming, July 1938, *F. L. Tai*, *5041*, **type!**

Pycniis epiphyllis, gregariis, 75–100 μ diam. *Aeciis* hypophyllis, in greges usque 1.2 mm. diam. annulatum dispositis, breviter cylindraceis, 137–212 μ diam., margine albo leniter revoluto; *cellulis peridii* firme conjunctis, rhomboideis usque oblongis, 16–23 x 16–19 μ, pariete exteriore levi 3–4 μ crasso, interiore dense verrucoso 1.5–2 μ crasso; sporis globosis vel angulato-globosis, dense verruculosis, episporio ca. 1 μ crasso, hyalino, 18–20 x 16–18 μ.

Aecidium anningense sp. nov.

On *Sophora viciifolia*. **Yunnan**: Anning, April 24, 1938, *S. T. Chao*, *4334*, **type!**

Pycniis non visis. *Aeciis* amphigenis, etiam in petiolis et caulibus evolutis, matricem deformatibus, dense gregariis, breviter cylindraceis, 150–250 μ diam., margine lacerato, non revoluto; *cellulis peridii* firme conjunctis, 27–50 x 13–29 μ, pariete exteriore striato 4–6 μ crasso, interiore dense verrucoso 2–3 μ crasso; *sporis* variabilibus, subglobosis, ellipsoideis vel oblongis, 29–30 x 13–19 μ, dense verruculosis, hyalinis, episporio 1.5–2 μ crasso.

Aecidium Rhamni-japonici Diet.

On *Rhamnus* sp. **Yunnan**: Kunming, *4625*.

Aecidium pulcherrimum Rav.

On *Buchemia* sp. **Yunnan**: Kunming, *4311*.

Aecidium Eleagni Diet.

On *Eleagnus pungens*. **Szechuan**: Chengtu, *6822*; Omeishan, *6820*. On *E. angustifolia*. **Shensi**: Linkiang, *4327*. On *E.* sp. **Yunnan**: Kunming. *4305*.

Aecidium Circaeae Ces. et Mont.

On *Circaea imaicola*. **Yunnan**: Kunming, *4634*.

Aecidium Fraxini-Bungeanae Diet.

On *Fraxinus chinensis*. **Szechuan**: Omeishan, *6818*.

Aecidium Osmanthi Syd. et Butl.

On *Osmanthus fragrans*. **Chekiang**: Hangchow, *8440*.

Aecidium Klugkistiana Diet.

On *Ligustrum* sp. **Hunan**: Yolushan, Changsha, *4746*, *4747*.

Aecidium foetidum Diet.

On *Mazus stachydifolius*. **Szechuan**: Chengtu, *7548*.

Aecidium Paederiae Diet.

On *Paederia* sp. **Yunnan**: Wenshan, *4312*, *4313*.

Aecidium Cardui Syd.

On *Cardus crispus*. **Chekiang**: Hangchow, *8439*.

CAEOMA Link.

Caeoma Warburgianum P. Henn.

On *Rosa Banksiae*. **Yunnan**: Kunming, *4624*, *4635*, *5730*, *6356*, *8010*, *8011*, *8012*, *8026*; Hualing, *7684*; Lunan, *8998*. On *R. lucens*. **Yunnan**: Kunming, *8009*.

Pycnia epiphyllous, gregarious in groups (2–5 mm. in diam.), subepidermal, 175–230 μ in diameter. *Aecia* hypophyllous, petiolous or caulicolous, gregarious on orbicular spots (3–5 mm. in diam.) or scattered, roundish, sometimes confluent, naked, 1–2 mm. in diameter, "flame-scarlet" or "salmon-orange" (Ridgway); *aeciospores* various in shape: ovate, subglobose, globose or oblong, 19–29 x 16–20 μ (ovate, subglobose or globose), 29–37 x 13–15 μ (oblong), epispore 1.5–2 μ thick, hyaline, densely verrucolose, contents orange yellow when fresh.

This rust fungus is very close to *Caeoma Warburgianum* except that the oblong spores are slightly longer in size. It is characteristic in its unusual large and subepidermal pycnia and aeciospores of irregular shape. *Caeoma Warburgianum* was described by P. Hennings in 1899 on material collected by Warburg in 1887 at Ningpo, Chekiang, and it has not been collected again until now. The present writer has taken pains to search for the other stages of this rust at Kunming for the past few seasons, but without success.

UREDO Pers.

Uredo Cynodontis-dactylis sp. nov.

On *Cynodon dactylon*. **Yunnan**: Kunming, Aug. 15, 1942, *W. F. Chiu*, *7913*, **type!**; **Szechuan**: Chengtu, *6830*.

Urediis amphigenis, rotundatis vel ellipticis, epidermide diutius tectis, dein ea fissa cinctis, sparsis, 0.5–0.8 mm. longis, subpulverulentis, castaneo-brunneis; *uredosporis* subglobosis, ovoideis, rarius ellipsoideis, 29–42 x 23–33 μ, echinulatis, castaneo-brunneis vel cinnamomeo-brunneis, episporio 1.5–2 μ crasso; *poris germinativis* 2 aequatorialibus praeditis; *paraphysibus* peripheric is, paucis, cylindraceis vel clavato-cylindraceis, flavidis, 37–57 x 13–18 μ, episporio 1.5–2 μ crasso.

This species differs from *Puccinia Cynodontis* in the larger and darker-colored uredospores and larger uredia; from *P. varians* in the larger and darker-colored uredospores, and from *P. Kühnii* in the darker-colored uredia and uredospores.

Uredo Arundinis-Donacis sp. nov.

On *Arundo Donax*. **Yunnan**: Kunming, June 2, 1938, *S. T. Chao, 7648*, **type!**

Urediis amphigenis, dense gregariis vel sparsis, rotundatis vel ellipticis, 0.5–1 mm. longis, epidermide diutius tectis, dein ea fissa cinctis, pulverulentis, castaneo-brunneis; *uredosporis* ovoideis, ellipsoideis vel oblongis, membrana ca. 2 μ crassa, ad apicem 3–4 μ crassa, cinnamomeo-brunneis vel subhyalinis, apice obscurioribus, echinulatis, 26–34 x 14–21 μ; *poris germinativis* 4 aequatorialibus praeditis; *paraphysibus* numerosis, capitatis, brunneolis vel subhyalinis.

Uredo Arthraxonis-ciliaris P. Henn.

On *Arthraxon hispidus*. **Yunnan**: Wenshan, *5037*.

Uredo Themedae Diet.

On *Themeda triandra*. **Szechuan**: Chengtu, *7557*.

Uredo Killingiae P. Henn.

On *Killingia brevifolia*. **Szechuan**: Chengtu, *7542*.

Uredo Verecunda Syd.

On *Achyranthes aspera*. **Yunnan**: Kunming, *4045*.

Uredo Deutziae Barcl.

On *Deutzia discolor*. **Yunnan**: Chichushan, Pinchuan, *4550*.

Uredo Panacis Syd.

On *Panax pseudo-ginseng*. **Yunnan**: Wenshan, *4527*; Sichour, *4528*, *6353*.

Uredia amphigenous, mainly epiphyllous, scattered or gregarious, roundish, 0.5–1 mm. in diameter, pulverulent, orange yellow; *uredospores* globose, subglobose or ellipsoid, echinulate, epispore 2–3 μ thick, hyaline, 23–29–(34) x 19–24 μ; *pores* obscure.

Uredo Colebrookiae Barcl.

On *Colebrookia oppositifolia*. **Yunnan**: Muhkiang, *6468*.

Uredia hypophyllous, scattered or usually densely gregarious, confluent, 0.35–0.6 mm. in diameter, pulverulent, yellowish; *uredospores* subglobose, epispore 1–1.5 μ thick, prominently and densely echinulate, subhyaline, 18–27 x 14–19 μ; *pores* obscure. The uredospores are slightly smaller than those described in the original diagnosis ("20–28 x 17–20").

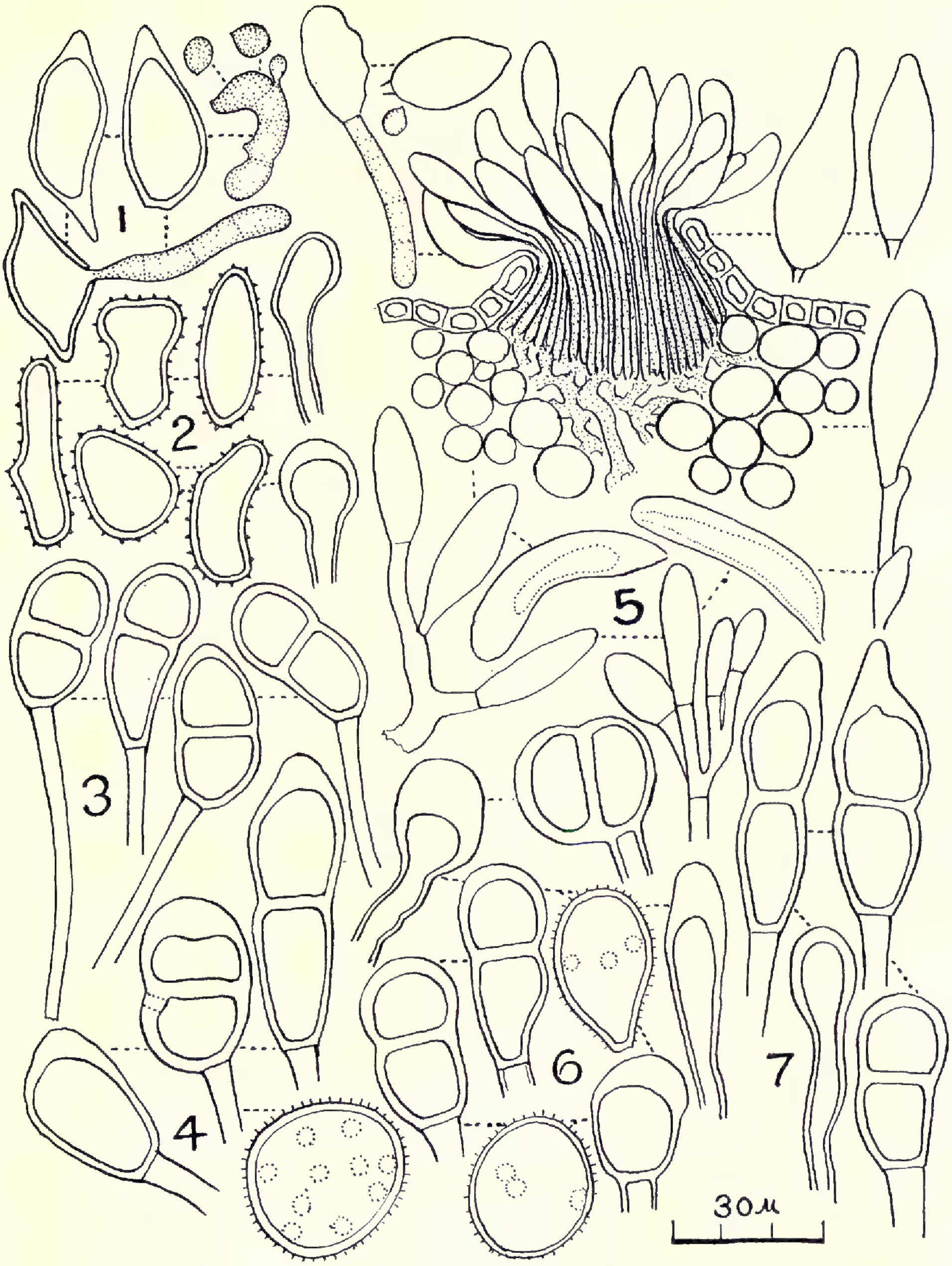
Uredo Zehneriae Thuem. (=*Uredo cantonensis* Yates)

On *Melothria* sp. **Yunnan**: Wenshan, *4398*.

EXPLANATION OF PLATE

Fig. 1–7.

1. *Cronartium Keteleeriae* Tai, teliospores.
2. *Melampsora Salicis-Cavaleriei* Tai, uredospores and paraphyses.
3. *Puccinia Festucae-ovinae* Tai, teliospores.
4. *Puccinia agrostidicola* Tai, uredospore, teliospores and mesospore.
5. *Gerwasia Rosae* Tai, section of a telium, teliospores, germinating teliospore, sporogenous hyphae and paraphyses.
6. *Puccinia Arundinellae-setosae* Tai, uredospores, teliospores, mesospore and paraphyses.
7. *Puccinia kwanhsienensis* Tai, teliospores and paraphysis.

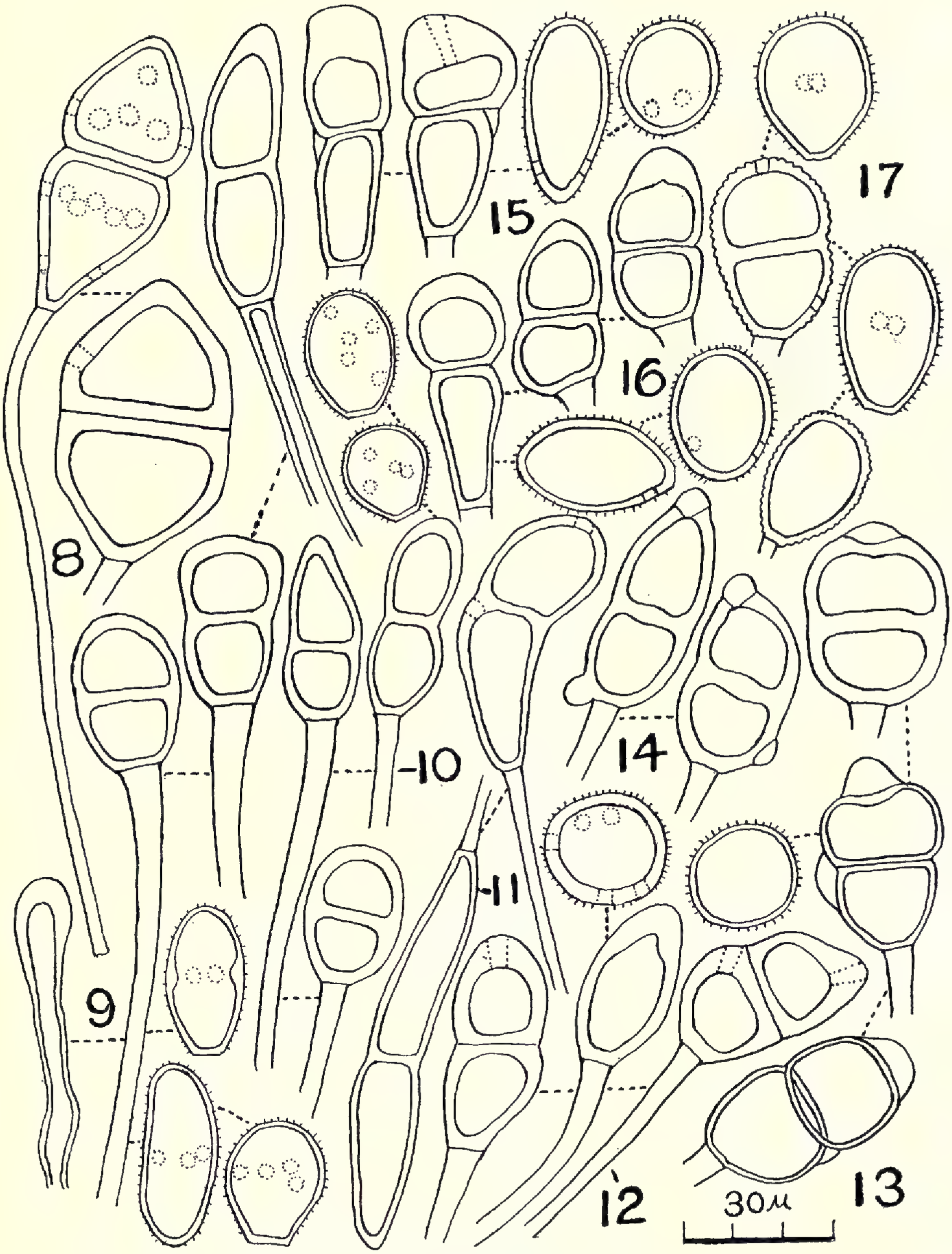


FIGURES 1–7

EXPLANATION OF PLATE

Fig. 8–17.

8. *Gymnosporangium Cunninghamianum* Barcl., teliospores, showing the position of the pores.
9. *Puccinia Kühnii* (Krug.) Butl., uredospores, teliospores and paraphysis.
10. *Puccinia Eragrostidis-ferrugineae* Tai, uredospores and teliospores.
11. *Puccinia Cinnamomi* Tai, teliospores.
12. *Puccinia taliensis* Tai, uredospore and teliospores.
13. *Puccinia leucophaea* Syd. & Butl., thick-walled and thin-walled teliospores.
14. *Puccinia clematidicola* Tai, teliospores.
15. *Puccinia polygonicola* Tai, uredospores and teliospores.
16. *Puccinia yunnanensis* Tai, uredospores and teliospores.
17. *Puccinia Glycyrhizae* Tai, uredospores, teliospore and mesospore.

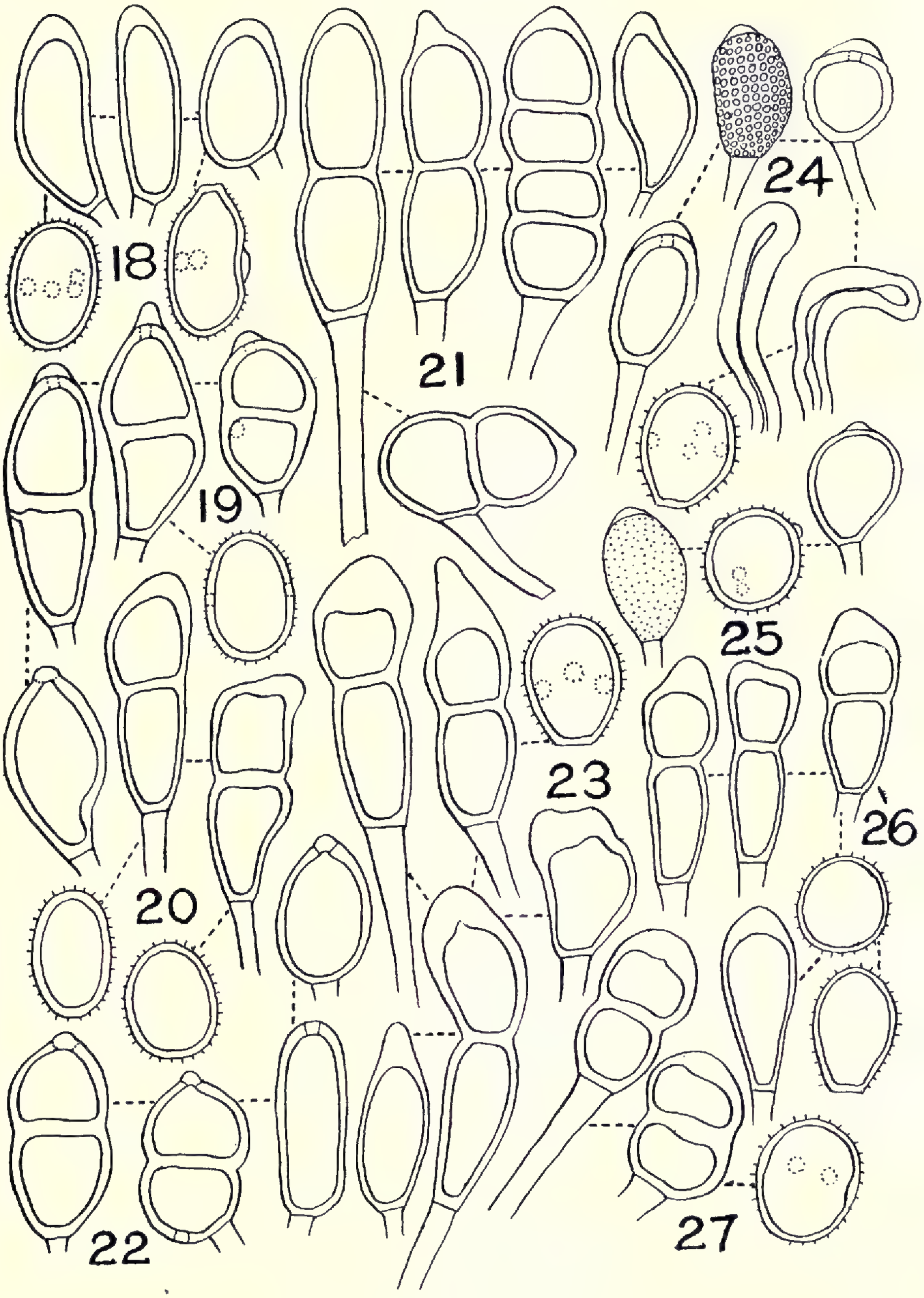


FIGURES 8–17

EXPLANATION OF PLATE

Fig. 18–27.

18. *Uromyces Sophorae-viciifoliae* Tai, uredospores and teliospores.
19. *Puccinia Impatientis-uliginosae* Tai, uredospore, teliospores and mesospore.
20. *Puccinia veratricola* Tai, uredospores and teliospores.
21. *Puccinia Saussureae-ussuriensis* Liou & Wang, teliospores and mesospore.
22. *Puccinia Wattiana* Barcl., teliospores and mesospores.
23. *Puccinia Yokokurae* P. Henn., uredospore, teliospores and mesospores.
24. *Uromyces rugulosus* Pat., uredospore, teliospores and paraphyses.
25. *Uromyces Kondoi* Miura, uredospore and teliospores.
26. *Puccinia Roscoeae* Barcl., uredospores, teliospores and mesospore.
27. *Puccinia Muehlenbeckiae* (Cooke) Syd., uredospore and teliospores.



FIGURES 18–27

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PLATE I

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By Dr. Edwin E. Honey in 1939.

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DAVID HUNT LINDER

WILLIAM H. WESTON

David Hunt Linder was born in Brookline, Massachusetts on September 24, 1899. From Noble and Greenough School he entered Harvard where he received his A.B., A.M., and Ph.D., in 1921, 1922, and 1926 respectively. During these years of study he served as assistant in Botany at Harvard in 1920–1921 and as Austin Teaching Fellow in 1922–1923. His first position was at Washington University, St. Louis, first as instructor from 1926–1929 and later as Assistant Professor from 1929–1931. During this period he was also mycologist for the Missouri Botanical Garden from 1927–1931. He returned to Harvard in 1931 and during the next two years was instructor in Botany. In 1932 he was made Acting Curator and two years later appointed Curator of the Farlow Herbarium and Library at which time he also became Lecturer in Botany. These positions he held for the remainder of his life. His study and teaching was supplemented by rich experience in field work. He spent the summer of 1922 in Nova Scotia serving as field assistant to Professor M. L. Fernald and in 1923–1924 collected and studied fungi in British Guiana as a Sheldon Traveling Fellow. In the summer of 1924 he assisted W. H. Weston on a survey of sugar cane diseases under the Tropical Plant Research Foundation, and in 1926–1927 gained further field experience as Botanist for the Harvard African Expedition to Liberia and the Belgian Congo. He arranged and participated in the active and productive summer forays of the Mycological Society of America. As a member of this Society he was particularly active, holding the offices of Secretary-Treasurer from 1936–1938, Vice President in 1939, President in 1940 and Counsellor in 1942 and 1943. He also represented the Society at the 6th International Botanical Congress in Amsterdam, Holland in 1935. In addition he was a member of the following societies: The New England Botanical Club, The Torrey Botanical Club, The Botanical Society of America, The Society of Plant Taxonomists, The British Mycological Society and The American Association for the Advancement of Science. His publications included nearly fifty papers dealing with a wide range of botanical subjects as well as with his own special field of the lower Basidiomycetes and certain groups of the Fungi Imperfecti. His career was terminated by his death on November 10, 1946.

Thus briefly can one sum up in a paragraph the essential activities of a life of valuable, contributive, scientific work. Such information, essential

though it may be, is wholly inadequate to do justice to the work of even the most inactive and unproductive. Certainly it is consummately inadequate to give any measure of evaluation of the active and contributive life of David Linder. Each mycologist, however humble or however great, has in some measure added to his own area of the field of science. Linder's contributions in the 20 highly productive years of his activity from 1926 to 1946 were notable and varied.

For his research Linder was internationally known especially for his authoritative monographic studies of certain difficult groups of the imperfect fungi. His monographs of the Helicosporeae, extensive and thorough, placed this previously little-known group of fungi on a sound basis. Similarly, his monogràphic studies of other hyphomycetous genera such as *Oidium* organized series of species previously in unfortunate confusion. Additional work extended our knowledge of other orders of the Imperfecti, such as the Sphaeropsidales and the Melanconiales, adding significant new genera and species and clarifying classification and relationships in the group. Not only in the Fungi Imperfecti but also in the Basidiomycetes his work contributed materially to mycological knowledge. His work on this extensive group ranged from studies of lower forms such as members of the Tremellales to his thorough monograph of the genus Schizophyllum among the Hymenomycetes and to research on various members of the Gasteromycetes.

His published papers include work of equally high standing in practically all of the major groups of fungi, and his knowledge of mycology as a whole was notably broad in its range and thorough in its comprehension. Although most of his work is concerned with terrestrial fungi, he was thoroughly familiar with the specialized aquatic groups, describing from British Guiana, early in his career, a distinctive new species of *Araiospora*, the most elaborate genus of the fresh-water Phycomycetes. Within recent years he collaborated in pioneer work on the hitherto unsuspected fungi that live submerged in sea water, his careful taxonomic studies of these unusual Fungi Imperfecti and Ascomycetes opening up a new field of investigation and revealing a group beautifully adapted in structure and development for successful survival and distribution under marine conditions.

An impressive number of more than 20 new genera and over 150 new species were established by him in the various groups on which his work centered, and so thorough and accurate were his studies that the position of these fungi new to science is secure and it seems highly improbable that any of them will be relegated to synonymy in the future or suffer serious changes in their taxonomic standing. It is deeply to be regretted that his monographic studies of an extensive series of species of *Exobasidium* which he had collected, grown in artificial culture and compared with exacting attention to the details of their development and cytology, will be left unfinished, for the members of this group are of especial interest, not only because of their injurious parasitism on cranberries, blueberries

and other valued members of the Ericaceae, but also because of their somewhat controversial position in the taxonomy of the Basidiomycetes as a natural group.

His productive work extended also even beyond the broad field of mycology, revealing a competency and versatility unusual in this day of specialization. His field work on the vegetation of Liberia and the Belgian Congo, resulting in a well-chosen collection of over 1600 specimens, added to our knowledge of the flora of those regions, and his very readable account of the occurrence, distribution, ecology and importance of the plants encountered on this African expedition reveals his wide botanical grasp. Similarly, his work on the lichens of the Galapagos and of Guadalupe and on the diatoms of the famous pre-Columbian fishweir excavated in Boston's historic Back Bay are further evidence of the breadth of his skill. Additional papers on mycological nomenclature and on the decisions reached on taxonomy and nomenclature at the sessions of the International Botanical Congress show his interest and his competency in these fundamental aspects of mycology, while his work on the evolution of the Basidiomycetes is stimulating in its effective grasp of the significance of the basidium as a means of interpreting the phylogeny of this large and highly developed group.

The several and very able joint contributions in which he collaborated with others furnish convincing evidence that, although preeminent as an independent investigator, he cooperated helpfully and effectively with his colleagues in creative projects, but it is notable that he never exploited joint authorship for his own advantage, hence the publications of students who worked for higher degrees under his guidance always appeared as contributions by the student himself, even though Linder in most cases had chosen and formulated the research problem and in all cases had contributed materially to the successful completion of the work.

The value of his contributions was enhanced by the versatility and artistry which he applied to illustrating them and the superlative accuracy and technical skill of his many drawings reveal the high standards of exactness and perfection which characterize all his work. He was quick to see the possibilities in various methods used by illustrators in non-scientific fields and versatile in applying these techniques to the illustration of his own mycological contributions. While the drawings in his early papers were done in conventional line and stipple with water-proof ink on Bristol Board, he soon turned to the potentially more flexible medium of the gypsum-coated stipple boards manufactured by Ross, and the success with which he developed this technique to bring out complicated three dimensional forms, surface modifications and various types of protoplasmic content is beautifully shown in the plates of his monograph of the Helicosporeae. He experimented also with the process employed by some commercial artists of using various patterns of stipple printed on thin transparent cellophane cut out and applied to cover suitable areas of the drawing, thus supplementing the ink stipple applied directly with the pen. Later,

turning to sheet celluloid, the texture of which suited his sure and skillful touch, he made on this medium many effective plates such as those illustrating his studies of *Coemansia* and *Oidium*, and developed very effective means of applying the "Sgraffito" technique for transitions of shading from solid black through intermediate tones to open line and stipple. In the last few years he had been experimenting with the "Craftint" method used by commercial illustrators for building up depth and tone of shading by brushing developing solutions onto the surface of prepared papers chemically impregnated with stipple patterns and the highly effective illustrations of some of the new genera and species on which he was working at the time of his death show his skill with this medium. These plates were used to illustrate the paper he presented at the Mycological Society meetings at St. Louis in March 1946, and will appear later in this journal when the descriptions of these striking new forms he found concerned in the tropical deterioration of textiles are completed by others who were associated with him in this work during the war.

Also, he was a master of photography and although only a small portion of the illustrations in his papers were of this sort, he effectively used various types of photography as helpful tools in his work. His early efforts included some excellent nature photographs of birds and plants in their natural habitats. Later he concentrated more on photographic illustrations of fungi not only in black and white but also in various color processes from the early Lumière to the later developments of Kodachrome and Kodacolor. Some of his high magnification photo micrographs of important structural features of fungi are unusually excellent and it was the cost of half-tone reproduction rather than any prejudiced preference for line and stipple drawings which prevented his using many of these high power photographs for illustration. His considerable skill in motion picture photography was not devoted directly to scientific ends as much as to supplementary illustration of mycological forays and other field work in which he was interested.

In other techniques contributive to his mycological work he was also highly skilled. After testing a wide variety of methods for making permanent mounts of the fungi with which he worked he at first recognized the suitability of Amann's lactophenol mounting medium and of Noyer's rosin-lanolin cement for sealing the coverglass on slides thus prepared. Later he even more successfully applied the double coverglass method of Diehl using pure glycerin as the mounting medium and synthetic resins for sealing. For the last two years he had been experimenting with a clear synthetic polymer, Plexigum, developed by Rohm & Haas, and had found in this material notable advantages for sealing the cover-glasses of microscopic mounts.

Although primarily concerned with taxonomy, nomenclature, relationship, phylogeny and similar aspects generally considered to be the more academic aspects of mycology he had a keen appreciation and quick grasp of the practical importance of the fungi. His address as retiring President

of the Mycological Society at its meeting in Philadelphia in late December 1940 gave timely expression to his sincere conviction that mycologists should be of helpful service in the war effort and pointed out the ways in which they could render effective aid to such essential activities as plant pathology, agriculture, and medicine and to such productive manufacturing as the textile industry and the commercial fermentations. It is, therefore, not surprising that, although he is most widely known for his outstanding work in fundamental mycology, he had, both independently and in helpful collaboration with others, contributed significantly to many fields of applied mycology.

In the field of plant pathology he collaborated with various investigators, helpfully contributing to their work on rots of timber trees, on destructive leaf spots of various crops in the United States, China and Latin America, and on injurious rusts and smuts of tropical and temperate plants. Left unfinished was the extensive work he was carrying on in collaboration with Dr. G. W. Fischer toward a monographic treatment of the smuts as a group. Also contributive to plant pathology were his studies of diseases of elm trees in Missouri, of the diseases of coffee, cacao, coconuts, and other important tropical plants in Dutch Guiana, of diseases of sugar cane in Cuba, and on such diseases as the black thread infection of rubber trees, the mosaic of cassava, and the red ring of coconut palms in Liberia.

To his medical colleagues he rendered invaluable aid by applying his unusually wide mycological knowledge to the stubborn and baffling fungi that are disfiguring or injurious in their attack on superficial human tissues such as the skin, hair and nails, or deadly in their invasion of more vital organs. In medical mycology he was not only helpful in his identification of the fungi concerned but also in his suggestions as to techniques of isolation and culture which proved to be of material aid in solving difficult problems. In the field of the importance of fungous spores in the air as causers of unusual types of inhalant allergy he not only aided his medical colleagues by authentic identification of puzzling forms but afforded them helpful guidance by his keen analysis of their problems from the mycological point of view.

In the field of horticulture his studies of the fungi which are essential to the growth of orchids developed improved methods for culturing and applying these fungi for the successful growing of highly prized orchid hybrids.

His suggestion, in his Presidential Address in 1940, that mycologists could be of aid to the textile industry through their knowledge of the fungi that cause the mildewing of cloth, foretold prophetically the field in which he was to render great service four years later, for during the war his tropical experience and his wide knowledge of the fungi were of great value in critical technical aspects of research on the deterioration of valuable equipment and supplies in the tropics. Since under tropical conditions mildew, mold, rot and other forms of fungous injury were notably accentuated, particularly on such necessarily exposed and highly valuable textiles

as tentage and tarpaulins, the program initiated by the Office of the Quartermaster General for the study and control of such losses was an important one.

In this program one of the first and essential phases was the determination of the identity, nature and abundance of the agents, chiefly fungi, which were involved. Among the activities of the Tropical Deterioration Administrative Committee, under Project AN14 of the National Defense Research Committee, there was established at Harvard Contract OEMsr–1389, from September 1944 through October 1945, followed by Quartermaster Corps Contract QM60 from November 1, 1945 through June 30, 1946, to carry on work on this phase of the program.

Since the effectiveness of this work was in large measure dependent on the thoroughness of the study and dependability of the identification of the fungi concerned in deterioration, the part played by Linder in his part-time work on these contracts during this period was an essential contribution. At Harvard over 4500 cultures of fungi were received, isolated, purified, studied, maintained and conserved for use in other phases of the program. In all, some 4025 of these were identified and while many of these were identified by specialists in certain difficult genera, such as *Penicillium* and *Fusarium*, the bulk of the identifications were made by Linder. The thoroughness of his work is evidenced by the fact that very few of even the most puzzling and baffling fungi encountered remained unidentified. Without his expert knowledge of the fungi as a whole and his especial familiarity with some of the more difficult groups of the Fungi Imperfecti, the accomplishment of the main objectives of the work of these contracts would not have been possible. His competence in this highly specialized technical field was appreciatively recognized by scientific members of the administrative groups of both the National Defense Research Committee and the Quartermaster Corps and his contribution to this phase of the war effort was gratefully acknowledged by the Office of the Quartermaster General.

In contrast to some mycologists who are highly competent in laboratory and herbarium investigation but ineffectual in field work, Linder was an exceedingly competent field worker, a keenly discerning observer, a collector with an uncanny gift for finding the rare but inconspicuous forms missed by others, a naturalist in the best sense. He never lost sight of the fact that a herbarium specimen, however excellent, is but a static representation of a living organism and that a pure culture in a tube or flask is not growing under the conditions which surround it in nature. In his boyhood he showed early aptitude as a naturalist and his eagerness for direct, first-hand study of living things in the surroundings in which they naturally grew was fostered first by his sympathetic and understanding parents as he grew up in the happy and favorable country environment of Canton, Massachusetts, and later by stimulating contacts with his great-uncle William Gilson Farlow, and by work with Dr. M. L. Fernald, whom he accompanied on field trips in New England during his college years and

assisted in a botanical collecting trip in Nova Scotia in the summer of 1922. His first extensive trip on his own to British and Dutch Guiana in 1923 on a Sheldon Fellowship from Harvard gave him a vivid and memorable introduction to the botanical luxuriance of the tropics and gained for him an unusual background of first-hand experience with the rich fungous flora of that relatively untouched region. While assisting on a survey of the losses from sugar cane diseases in Cuba in the summer of 1924, he not only gained practical experience in plant pathology but also, since he was a keen observer and an indefatigable collector, extended his knowledge of other tropical fungi and acquired considerable valuable material, some of which became the subject of later publications. His field experience as botanist on the Harvard African expedition to Liberia and the Belgian Congo in 1926 and 1927 under the direction of Dr. R. P. Strong of the Harvard Medical School gave him an unusual opportunity for further development as a botanist, and as might have been predicted he not only fulfilled his job as botanist with the highest competency but also as a mycologist enriched his rapidly growing knowledge by his eager study of the rich flora, and by collecting valuable material for later work. Although the bulk of his work on this expedition was with the higher plants, it is notable that in the collection of over 200 fungi which he assembled he showed such a flair for interesting and significant material that among the specimens he collected significant additions to science are still being uncovered. The remarkable and distinctive new genus *Linderella*, which he collected in Banga, Liberia and which will be described in full in a later number of this journal, is but another example of his unusual discrimination as a collector.

This eagerness for field work he never lost even when the pressure of responsibilities as Curator and Lecturer at Harvard made any long trips to distant localities impossible. He collected and carried on field work actively in this vicinity and on his brief vacations either took an active part in various forays of the Mycological Society or on his summer trips by automobile combined the happy objectives of visiting his many botanical friends and of collecting extensively from Canada and upper New England in the north, to the Great Smoky Mountains in the south.

As a teacher he was especially effective in guiding investigation of the material itself, hence unusually stimulating in instigating and fostering the research of more advanced students. To the development of the seven graduate students who attained their Ph.D. degrees under his helpful and stimulating guidance he contributed notably and their work has maintained a standard of excellence highly creditable not only to themselves but to him. He has been characterized as being neither a colorful nor a compelling lecturer and this criticism is just for he was not at ease when lecturing and found it difficult to present material spontaneously. Realizing this he was extremely painstaking in the preparation of his lectures, assembling in careful and effective organization a wealth of material thoroughly covering the subject and usually writing out his lectures in finished

form wholly suitable for publication, to be read in full as written. His lectures, therefore, made up in organization and in coverage what they may have lacked in colorful presentation and they were highly valuable to the student interested in the subject and eager to gain a sound knowledge of it. At times, as when giving informal accounts of his travels and mycological field work in such fascinating regions as British and Dutch Guiana or Africa he lost his constraint and his lecturing became wholly interesting and enjoyable.

While the criticism of his lecturing is just, it in no sense implies that he was not successful as a teacher. On the contrary, with small groups of interested workers under informal conditions or when concerned directly with the material itself he showed himself to be a born teacher, informative, enlightening and stimulating. He had the qualities essential for effective teaching: a natural and contagious enthusiasm, a stimulating and original point of view, a keen analysis of problems, a wealth of pertinent information sincerely and directly given. These characteristics were so fundamentally a part of him that they were not reserved for his informal teaching in the laboratory but made him a stimulating and informative member of any group with which he was associated. It was these qualities that made him notably successful in the many contacts involved in his activity as Curator of the Farlow Herbarium and every visiting worker, whether interested amateur, neophyte student, travelling Fellow, or recognized authority in some special field, gained help and impetus from association with him. It was these qualities also, in addition to his expert knowledge, that contributed to the success of the contract work on the fungi concerned in deterioration during the war, and the members of this research group were indebted repeatedly to his unusual ability to sense the extent of their knowledge and to supply the timely suggestions that rapidly improved their techniques and skills and expedited the progress of the work. Since he had a very practical understanding of what effective teaching actually involved, Linder was not overawed by impressive programs and pretentious plans for new thaumaturgies in Education (in capitals and with a resplendent halo) but it was notable that in any constructive departmental or academic activities he was always ready to contribute his full share of hard work. Following the same general pattern he would gladly devote a large amount of time and effort to developing a man's ability to do productive research of the highest caliber but was not inclined to spend hours of inconclusive discussion to foster a student's tendencies to theoretical speculation in nebulous realms of biological philosophy.

For his work as Curator of the Farlow Herbarium and Library Linder is perhaps most widely known and it is the opinion of some that this was his greatest contribution to Botany. Becoming Acting Curator in 1932, after the death of Dr. Thaxter, he served in this capacity for two years so effectively that he was appointed Curator on September 1, 1934, thus devoting in all fourteen years to this phase of his life's work. At the very outset his objective was clear: — to make the Farlow Herbarium and

PLATE II

Another informal portrait of Dr. Linder taken by Dr. Vincent Dethier at the Farlow, probably in 1941.

Library a productive and functional institution of useful service to Botany. To this purpose he devoted himself wholeheartedly, achieving a large measure of success despite the handicaps of very inadequate funds and of merely lukewarm backing from the University administration. He not only maintained the Farlow in its long standing position of prestige but further augmented its material assets and its usefulness until it is now preeminent in its field. Since 1932 nearly 18,000 items, many of them of especial value and all of them of significant utility, have been added to the Library while the Herbarium has been increased by over 200,000 specimens including such valuable lots as the Bartholomew and Blackford collections of fungi, the Haynes and Verdoorn collections of hepatics, the Scott collection of algae, the Cheever collection of diatoms, and the Sprague collection of lichens. The scientific value of these accessions can be appreciated only if one appraises them according to Linder's own exacting standards, insisting that a herbarium must be a functional adjunct to field and laboratory work and must consist not of impressive numbers of inactive accumulations but of vitally useful material, the essential tools for active investigation. The scope to which he extended the usefulness of the Herbarium can be estimated from the fact that under his direction a total of over 50,000 specimens were sent on loan to experts in this country and abroad to aid them in their investigations in pure and applied fields. The usefulness of both the Herbarium and Library was increased also by his developing and extending the several essential index file systems that facilitate rapid finding of pertinent material.

The amount of work that was necessary to achieve all this can be appreciated only by those who have served in similar capacities, and in addition there were the demands of carrying on a voluminous correspondence, of identifying large numbers of specimens, of teaching and other academic duties. It is not surprising that his own research was done chiefly in the evenings at his home. Since Philip Rusden, in his sympathetic and thorough biographical note which should appear in Mycologia before this is published, has emphasized Linder's curatorial activities in full with pertinent data supplied by Miss Hilda Harris from her 14 years' association with the Farlow as librarian, no further details need be given here.

There are, however, certain additional points that should be noted. Linder has been criticized for doing too much of the routine work instead of relegating it to others and there is some basis for this criticism but it should be remembered that his conscientiousness would not permit him to lower his standards and that his staff, although competent and loyal, was inadequate in number and could not be increased because of limited funds. To the administrator, usually predominantly endomorph in psychosomatic pattern, the overconscientiousness of an ectomorph scientist, who would scrub floors himself rather than have a dirty laboratory greet visiting botanists, is naturally incomprehensible and open to criticism. Criticism has been raised also against the reiteration in his yearly reports of the

need for more adequate support if the Farlow Herbarium and Library was to meet its responsibilities. On reading over these reports, the writer finds no querulous complaining that would justify annoyance, but rather a steady, restrained insistence on what Linder felt it was his duty as Curator to emphasize. Also these reports reveal a competent man devoted to his work, the type of man who, if those in power had dealt with him directly in occasional conferences instead of delegating the job to others, would readily have cooperated in some constructive compromise. It should be noted that in all his years as Curator the insistence was always on the inadequacy of support for the Herbarium and Library with never any complaining about his own comparatively meagre and perennially static salary.

Under Linder's curatorship the atmosphere of the Farlow became congenial and cooperative, highly conducive to productive work by visiting botanists. The priceless and irreplaceable type materials, the rare and valuable books were conserved, not by hoarding them as functionless accumulations under jealous and selfish guardianship, but by giving them the greatest possible usefulness, yet through judicious care and thorough efficient organization and ingenious devices such as typeslides making them serviceable, while conserving them for future service. Thus the Farlow served not as an end in itself, a monumental repository for hoarded collections, but as a functional means to the end of furnishing the unequalled material which, in the hands of competent investigators with Linder's stimulating aid, resulted in the production of contributions valuable to science. It was only natural, therefore, that the fame of the Farlow Herbarium and Library became widespread in this country and abroad so that botanists from many different institutions came to work there in ever-increasing numbers and the Visitors' Book became a roster of those productively active in various areas of Cryptogamic Botany. With many of these Linder maintained contact through an extensive correspondence, stimulating their productive work and aiding them with his unusual knowledge and with loans of helpful material. His aid to beginners was effective and encouraging, his collaboration with advanced specialists highly productive, as several joint papers in different fields of mycology testify. More than this, he was a genial host, a stimulating consultant and a helpful associate so that all of the visiting botanists who spent even short periods working at the Farlow found that through him they gained much more than mere access to the material and volumes pertinent to their work.

His early plans for extending the usefulness of the Farlow Herbarium and Library were thoroughly sound and showed far-sighted vision and it is to be regretted that limited funds and support prevented carrying out his program. It was his hope to foster monographic studies of genera, particularly among the fungi of importance to medicine and to plant pathology, by securing fellowships to aid those competent to carry on such work. It was his hope also to establish curatorships of the various groups of

cryptogams so richly represented in the Farlow collections and thus to stimulate productive work on these groups. It was his hope to establish a periodical of wide scope and ample space, since the series of "Contributions from the Cryptogamic Laboratories and from the Farlow Herbarium" to which he contributed many significant papers had, as he realized, the unavoidable limitations of the journals in which the separate numbers appeared. The establishment of "Farlowia" in January 1943 was the fulfillment of one of his plans of 1934 and the result of his long realization of the need, expressed in his presidential address of 1940, of a taxonomic journal for Cryptogamic Botany that would be a publishing outlet for monographs of greater length than could be accommodated by the existent periodicals with their necessary restrictions as to the acceptable length of papers. That "Farlowia" has won a definite place for itself in these four years is the result not only of meeting this long-foreseen need but also of his own efforts and those of Edgar Seeler, Miss Harris and others of the staff to maintain the high standards he had set.

The pattern of Linder's years of constructive activity, so briefly summarized at the very beginning of this paper, thus takes form commanding our admiration and our respect. Yet this is inadequate and incomplete without the color and warmth of his personality, the quickening vitality of his qualities as a man as well as a scientist. Sincerity and loyalty together with integrity and undeviating adherence to the highest standards were inherent in his nature and gave him strong qualities of leadership. In him there was an enduring dependability and an unfailing courage. Unselfishness, helpfulness and consideration for others were dominant qualities which characterized him throughout his life. Natural friendliness and spontaneous hospitality were characteristic of him as were a keen sense of humor and a ready wit.

It was his personality that gave color and vitality to his activities. To his students his friendliness and his sympathetic understanding of their problems enriched his careful teaching and his competent guidance of their research. To his colleagues, as to all those who were associated with him in his years of work at the Farlow Herbarium and in the Department of Biology at Harvard, it was his qualities as a man as well as his unusual ability in his own field that made working with him so congenial. The loyalty of the staff at the Herbarium and Library was in response to his leadership and the esprit de corps which distinguished that small but productive group of workers stemmed from him. Similarly in the long hours of work under the war contracts his genial personality contributed much to the spirit which made those years of intense, concentrated activity so vivid and memorable.

His personality as well as his recognized preeminence as a mycologist contributed both to his success as Curator of the Farlow Herbarium and Library and to the wide prestige of that institution. The many letters that arrived after his death became known are moving in their tribute to him, warm evidence that even a brief period of scientific work at the Farlow

Herbarium was to the visiting botanists a rich experience, memorable, quite apart from the material facilities, both for the many ways in which Linder fostered and aided their investigation and for his stimulating companionship and natural hospitality. The temptation to quote from all of these is strong but perhaps one example will serve. J. R. Bartholomew, whose work on Diatoms is well known and whose long association with Linder had involved contributive activity as Honorary Curator of Diatoms and as one of the editorial board of "Farlowia," wrote appreciatively of the turning point in his own work when, feeling that "making hooked rugs would be more useful to humanity" than his investigation of Diatoms, he turned to Linder and received from him the dynamic stimulus ("every time he lit a cigarette he had a new idea") that reoriented and revitalized his investigations. His concluding paragraph typifies what Linder's curatorship at the Farlow meant to a large number of workers in many fields: —

"Diatomists as a rule are amateur scientists. They are apt to take themselves seriously, possibly because no one else does, and hence as a rule established Herbaria and their Curators are apt to look down their noses when these pariahs and outcasts knock at the door. Let no one make this statement about Dr. Linder or the Farlow. One could always find a place to work, a magnificent library and friendly, inspiring co-operation."

The lighter side of Linder was thoroughly delightful, an enlivening part of the unusual combination of qualities which endeared him to his friends. His ready wit was part of this and his quickness for just the touch of comic relief that fitted the occasion. He had an aptitude for mimicry and for genial and kindly fooling. It was these qualities as well as the informal training in field work which have made the days in the country with him so happily remembered by the students who in groups of sometimes as many as a dozen used to be invited every weekend from April through June to his home on the outskirts of St. Louis. The same enlivening touch was treasured by the students who worked with him at Harvard and, in the activities of the graduate scientific fraternity, Gamma Alpha, it was this which helped make him one of the most well-liked of the faculty members. In the Farlow Herbarium this touch contributed to the geniality of the atmosphere, and in the brief but enjoyable respite for tea and coffee in the afternoon it was interspersed with the serious and productive shop talk. Perhaps it will not be out of place to mention one or two characteristic incidents. When "Farlowia" was being established and mailing lists for the preliminary prospectus were being assembled, Mrs. Riddle, who had done the major part of this work, was told that if she brought the list to two thousand this achievement would be commemorated by a special issue with her picture on the cover in place of the head of Dr. Farlow. Since this goal was approximately attained, Linder, by retouching a photograph of Mrs. Riddle, prepared a silhouette which was adroitly stuck on in place of that of Farlow. So neatly was this done

that for a time she was completely taken in and appropriately disturbed that the first issue should be thus embellished.

Also, although guests were usually taken by Linder to the more pretentious Faculty Club for lunch, those who worked for some time in the Herbarium would often join the enjoyable informal staff lunches in the front room. On one of these occasions when Dr. H. S. Jackson of Toronto was a guest, the conversation, amid discussions of phylogeny in the Basidiomycetes, was turned adroitly by Linder to comparison of food shortages in the United States with those in Canada. As an example of how much more the shortage had affected Cambridge, Dr. Linder, with the impish gleam in his eye familiar to his close friends, said that eggs had grown notably smaller and smaller in consequence and at this point set before Dr. Jackson two boiled starling's eggs gathered for the occasion from the nests of some of the many starlings which, quite appropriately, had also found the Farlow a congenial place for productive work. It is characteristic of Linder's blend of happy foolery and scientific curiosity that once the jest had been effectively sprung and the eggs had been opened with due ceremony he was much interested by the fact that these eggs, although much smaller and boiled for the same time as the hen's eggs that had been kept in reserve, were still only slightly coagulated.

His unfailing courage was so unobtrusive that only those of us who were close to him realized how often it sustained him through the handicaps of his long years of suffering from high blood pressure. He continued his work with a staunchness that won the admiration of all of us. Only the drawn look around his eyes, and the beads of perspiration on his upper lip revealed the strain he was undergoing and only rarely, with the quiet remark that he would have to go home and lie down, would he show the toll which the frequent splitting headaches were exacting from him. He had in large measure the quality of grace under adversity. This, together with his other fine qualities, contributed notably to making him the best sort of companion on expeditions, especially when the going was really grim. In our many months of field work together in Cuba there were many such occasions that demonstrated this quality of his, and companions on the African Expedition have spoken warmly of how great an asset to the group, even under the most difficult and trying situations, Linder invariably proved.

It is understandable that those of us who had been closely associated with him can not quite realize that he is gone. The sense of loss from his death is deepened by the realization that at the age of 48, many years of the productive work he enjoyed should still have stretched before him.[1]

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CAMBRIDGE, MASSACHUSETTS

[1] Since the complete list of Dr. Linder's publications compiled by Miss Hilda Harris, Librarian of the Farlow Library, has already appeared in Mycologia, accompanying Philip Rusden's biographical sketch, the reader is referred to that article, and the list will not be duplicated here. (See Mycologia **39**: 133–144, 1 pl. 1947.)

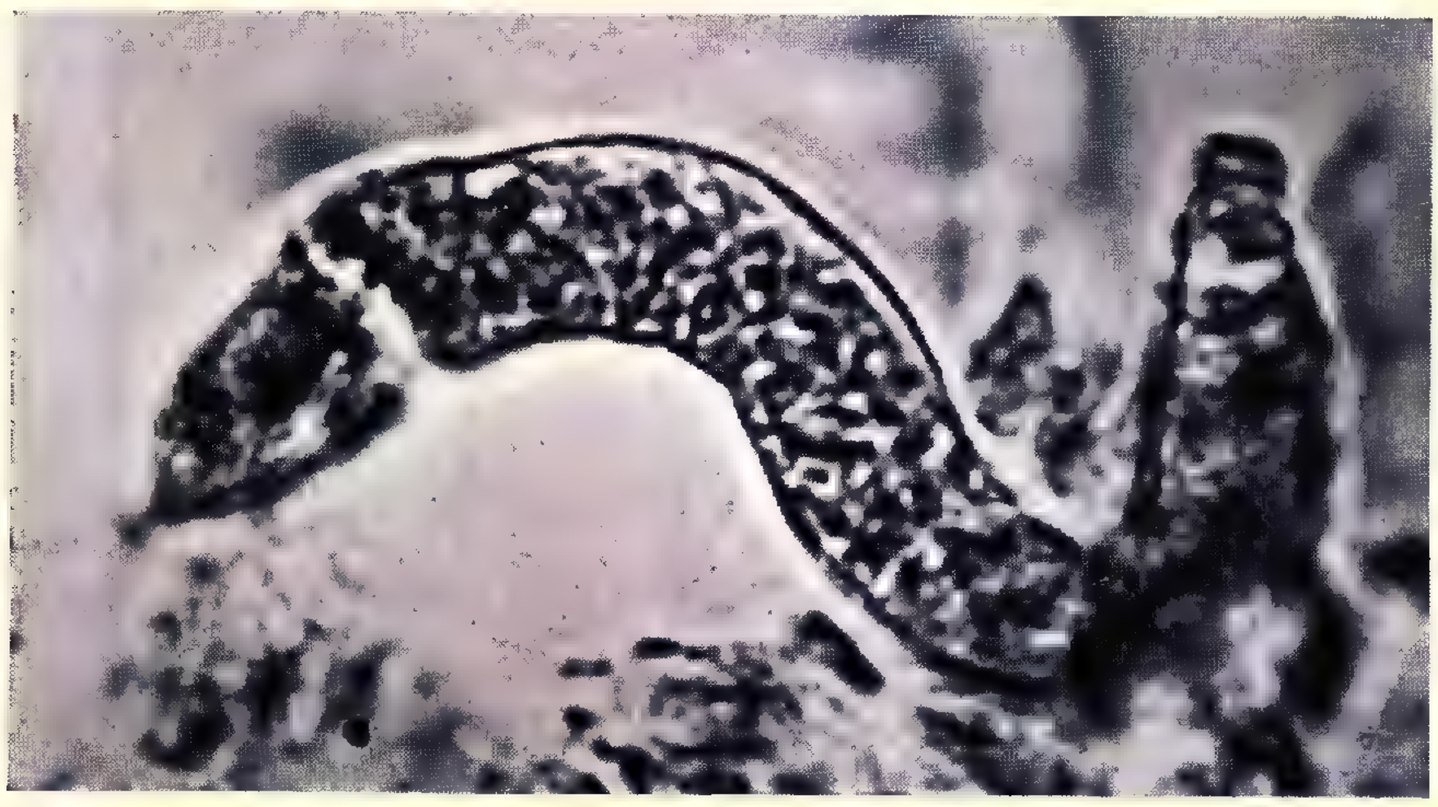
3(2): 155–157 FARLOWIA JULY, 1947

COSCINOIDS AND COSCINOCYSTIDIA IN LINDEROMYCES LATERITIUS

ROLF SINGER

Several tropical species of *Paxillus* are remarkable because of their large, rough, warty, or reticulate spores. The author has (*in* Ann. Mycol. **40**:59. 1942) tentatively placed all these species in the genus *Phyllobolites* with a Brazilian species, *P. coccineus* Rick, as type species. In spite of all the efforts of Dr. Rick and other Brazilian colleagues, the type could not be located and seems to be lost. Later collections proved to be misdeterminations (also according to J. Rick *in litt.*), and belong to *Paxillus panuoides* and *Pleurotus* sp. Under the circumstances, it appears that the existence of *Paxillus coccineus* is highly doubtful.

The author's efforts to study the type material of another rough-spored *Paxillus* were more successful. Thanks to a loan of the type material of *Paxillus lateritius*, a species described by Petch from Ceylon, the author is now in a position to confirm the independent generic status of this species. It is unique because of the presence of a conductive system unknown, thus far, in Agaricales in particular, and apparently in fungi in general. The whole carpophore consists of two types of elements, (1) ordinary hyphae which are hyaline or nearly so, filamentous, and provided with clamp connections and thin walls that collapse easily, and (2) of numerous conducting elements that differ from all known types of laticifers, oleiferous hyphae, gloeo-vessels, etc. by their curious sieve- or sponge-like structure (see Text Fig. 1). They are long, filamentous, aseptate, brown bodies with a pitted, sieve-like surface. The perforations of the surface, however, do not lead, as might be expected, into a tubular cavity as in other conductive elements; they are merely the orifices of densely mean-



TEXT FIG. 1. Fragment of a coscinoid in the type of *Linderomyces lateritius*, at first treated with KOH, then dyed with phloxine and imbedded in Shear's mounting fluid × 1200. Photomicrograph Singer & Frank White.

dering holes of the same diameter as the orifices, and separated by a wall substance that is colored deep brown by an insoluble membrana-pigment in the sense of Kühner. The whole structure can therefore be compared with a filamentous sponge. Only the apices of these elements are sometimes hair-like, and, rarely, septate without clamps.

This new type of conductive element is called **coscinoid** by the author — (koskinion-sieve).

The coscinoids project in both the cortical and the hymenial layers of the carpophore, forming cystidia-like terminal bodies, perpendicular to the surfaces, and parallel to the basidia, many of them projecting beyond the level of the sterigmata and the tips of the cuticular elements. In a general way, therefore, they may be considered as pseudocystidia and dermatopseudocystidia; yet they differ from all known types of pseudocystidia in their structure which is identical with that of the coscinoids from which they are hardly separated, and usually little differentiated. Their apices are either obtuse or acute, and their diameter is from 2.5 to 10 μ.

This new type of pseudocystidium is called **coscinocystidium** by the author.

The coscinoids that run through the hymenophoral trama are distributed in a strongly divergent-bilateral arrangement, *i.e.* they curve outwards from a central axillar strand, in both directions bending into a nearly 90° turn toward the hymenium. This divergence is more distinct and sudden than in *Paxillus involutus*, and probably more so than the divergence of the normal hyaline hyphae of *Paxillus lateritius* itself; but in the type specimen, these hyphae are not well enough preserved to allow a comparison.

The bilateral trama and the brownish spores, together with the macroscopical features, prove that this plant belongs in the family Paxillaceae. In fact, its external appearance is strongly reminiscent of *Paxillus involutus*. However, there are also numerous differences. The spores are actually rough, as described by Petch, and more voluminous than in any species of *Paxillus*, *viz* 9.3 — 13.5 $\times$ 5.2 — 10.2 μ. The spore ornamentation is difficult to interpret since it is not chemically different from the main episporium, also not deeper colored than the optical background. The outline of the spore in optical section is minutely wavy, and the rugosities seem to be due to alternating thickenings in the wall. This structure is very unlike that in the punctate spores of *Crepidotus*, sect. *Echinospori*, and *Tubaria thermophila* where the episporium is interrupted by deeper colored imbedded short-cylindric punctations, and it is also different from the ornamentation of *Cortinarius* where deeper colored warts form an outer layer (exosporium?) between the episporium and perisporium. As might be expected, there is no plage (smooth suprahilar spot) in the suprahilar depression of the spores of *Paxillus lateritius*. In the cuticle whose structure is not clearly decipherable in the material at hand, the author observed a bright yellow pigment that is soluble in ammonium hydroxide and probably intercellular, much like the pigment found in the hymenophore of

Pulveroboletus auriporus (Peck) Sing. Cresyl blue stains did not reveal any remarkable metachromatic coloration of the spores or the hyphae. Alkali darkens all sections of the fungus.

All these characters demonstrate that *Paxillus lateritius* is not congeneric with *Paxillus involutus*, nor with any other species described in *Paxillus* or in other genera.

It is therefore proposed as the type species (*typus generis*) of a new genus, *Linderomyces*, named in honor of David H. Linder, the late curator of the Farlow Herbarium, and a dear friend and co-worker. Always interested in the work accomplished by the members of the staff, always generous with valuable suggestions and ready to help when necessary, he was witness to the discovery of the strange anatomical features of Petch's type, and had hoped to take part in its further examination and illustration shortly before his last illness set an end to all his plans.

LINDEROMYCES, gen nov.

Genus Paxillacearum; carpophoris pileatis, centraliter stipitatis, reactione alcalina atrofuscescentibus, hymenophoro lamellari infero praeditis, pigmento laeto coloratis; siccis brunnescentibus, in vegeto carnosis, phaeosporis, terrestribus. Habitu Paxillum involutum in mentem revocante; lamellis confertis, subsimplicibus, angustis; carne autoxydatione mutante; hyphis hyalinis, filamentosis, fibulatis, tenuitunicatis; elementis coscinoideis numerosis, brunneis; coscinocystidiis in hymenio et in cuticulis praesentibus; tramate hymenophorali bilaterali; sporis voluminosis, brunneolis, ellipsoideis, asperulatis, disco levi in depressione suprahilari destitutis. Ad terram.

Typus generis est **Linderomyces lateritius** (Petch) Sing. comb. nov. = *Paxillus lateritius* Petch.

The author wishes to express his gratitude to the Director of the Royal Botanic Gardens, Kew, England, for the loan of the type specimen of *Paxillus lateritius*.

FARLOW HERBARIUM
HARVARD UNIVERSITY
CAMBRIDGE, MASSACHUSETTS

3(2):159–215 FARLOWIA JULY, 1947

THE MARINE ALGAE OF OREGON

PART II. RHODOPHYTA

MAXWELL S. DOTY

There follows a continuation of the annotated systematic list of the marine algae of Oregon which began with the Chlorophyta and Phaeophyta in Part I.[1]

DIVISION RHODOPHYTA
RHODOPHYCEAE
BANGIALES
ERYTHROTRICHIACEAE
ERYTHROTRICHIA Areschoug, 1850

Erythrotrichia Welwitschii (Ruprecht) Batters, 1902:55; — Smith, 1944:163. *pl. 36, figs. 1–2.*

Arising from a monostromatic base on rocks and corallines at South Bay (*MD 5048*, July). The filaments often with spores and with geniculations resulting from the enlargement of one or more cells originally cut off in a diagonal manner.

Erythrotrichia sp.

With intramatrical rhizoids descending from the basal 6–12 cells; filaments about 35 μ in diameter throughout; cells in the upper portion often longitudinally divided and about one third as long as broad.

With and on *Ulva vexata* (*MD 6114*, north shore of Chetco Cove).

Erythrotrichia pulvinata Gardner, 1927a:238. *pl. 24, figs. 1–3*; — Smith, 1944:164. *pl. 36, fig. 3.*

On skeleton of *Strongylocentrotus purpuratus* (sea urchin) lodged at the HHLW levels, Middle Bay, July (*MD 4894b*).

ERYTHROCLADIA Rosenvinge, 1909

Erythrocladia irregularis Rosenvinge, 1909:73; — Smith, 1944:166. *pl. 37, fig. 1.*

On the main axes of *Antithamnion* (*MD 5028b*) at Lighthouse Beach, and elsewhere on other algae.

Erythrocladia subintegra Rosenvinge, 1909:73; — Smith, 1944:166. *pl. 36, fig.* 6.

On *Scytosiphon* and *Ilea* (*MD 2454*, July) at Squaw Island and on other algae elsewhere.

BANGIACEAE
BANGIA Lyngbye, 1819

Bangia vermicularis Harvey, 1858:55. *pl.* 49; — Smith, 1944:167. *pl. 37, figs. 4–6.*

Common throughout the range. Cystocarpic material of this species has

[1] Part I. Chlorophyta and Phaeophyta. Farlowia **3** (1):1–65. 1947.

been collected on rocks and was intermingled with *Urospora penicilliformis* (*MD 6181b*, Rogue River Reef, July, at the plus 2.0 foot level). In fertile segments of uniseriate filaments, each cell had undergone two divisions with each of the four resultant cells putting forth a trichogyne. These filaments were 23–25 μ in diameter in the fertile portion. Filaments collected in summer are relatively slender, short and dark purple in color; and they become longer as the season progresses. In winter and early spring thalli of this species are much larger, brownish, and at times hollow.

PORPHYRA C. Agardh, 1824

Porphyra naiadum Anderson, *apud* Blankinship & Keeler, 1892:148; — Smith, 1944: 169. *pl. 40, fig. 1.*

Throughout the range on *Phyllospadix* and *Zostera*. There seems to be no qualitative difference between the forms *major* and *minor* of Hus (1902: 213).

Porphyra nereocystis Anderson, *apud* Blankinship & Keeler, 1892:149; — Smith, 1944:171. *pl. 37, fig. 7.*

Epiphytic on *Nereocystis* throughout the range. The abundance of this alga varies greatly from year to year.

Porphyra schizophylla Hollenberg, *apud* Smith & Hollenberg, 1943:213. *figs. 6–7*; — Smith, 1944:173. *pl. 39, fig. 4*; *pl. 40, fig. 4.*

Growing above the top of the *Pelvetiopsis*-zone above the LHLW [2] level to a height of 14–20 feet above mean lower low water. Since this is about 15 feet above the level of the usual high tides and 11 feet above the very highest tides, this alga lives where spray or rain is the only source of moisture. From the appearance when collected in early July (*MD 6201*, Harris State Park) it seems clear that it must be a winter or early spring species. The thalli were fruiting but the uppermost members of the stand were very pale in color and appeared more or less dead. The alga at the above locality was on the vertical faces of rocky islets facing the ocean. Both spermatangial and carposporic material was collected. Another collection (*MD 6186*) was made at Otter Point from the same habitat.

The Oregon material, while less eroded and more discolored than the type material in the Dudley Herbarium (*306400*), compares very well with it in texture, stature, and general coloration. The anatomical details are also similar to the type. However, the cell lumina are somewhat smaller and the cells, especially those of the carposporic material, are pyriform but with the narrowed ends directed outward. The trichogynes are very slender and at times almost as long as the long diameter of the cell producing them.

Porphyra lanceolata (Setchell & Hus) G. M. Smith, *apud* Smith & Hollenberg, 1943: 213. *figs. 8–10*; — Smith, 1944:170. *pl. 38, figs. 1–2*; *pl. 40, fig. 3.*

Throughout the range and often pendant from overhanging rocks, us-

[2] For a detailed characterization of these levels see Doty, 1946.

ually at approximately the HHLW level or just above, but one collection at Middle Bay (*MD 4112*) was in the spray zone.

Porphyra perforata J. Agardh, 1883:69; — Smith, 1944:172. *pl. 39, fig. 5.*

Throughout the range between HHLW and LHLW tide levels. Usually on rocks but at times epiphytic on *Iridophycus* and other algae.

Porphyra occidentalis Setchell & Hus, *apud* Hus, 1900:69; — Smith 1944:174. *pl. 39, fig. 1.*

Throughout the range south from Cape Arago on rocks between the MLLW and LLLW levels.

There are three different forms referred to this species. For the most part the thalli of the specimens alloted to this species are 11–15 cm. broad and up to 100 cm. long. However collections have been made more than once of thalli less than 2 cm. broad and up to 15 cm. long. In some collections the thalli are of a deeper violet color, deeply incised and 5–8 cm. broad by 20 cm. tall. These three forms are quite similar in microscopic dimensions. When fruiting all three have the same characteristic slimy texture, and male thalli have the same yellow-green margins. Homothallic with the carposporic areas lying inward from the spermatangial area. The fertile female area with relatively few sterile cells. Carpospores in packets of 16.

Porphyra variegata (Kjellman) Hus, 1900:69; — Smith, 1944:173. *pl. 38, fig. 3.*

On rocks nearly buried in the sand just below the HHLW level along the northeast shore of Sunset Bay in June (*MD 4593*) and at Squaw Island (*MD 2358*).

Porphyra miniata var. **cuneiformis** Setchell & Hus, *apud* Hus, 1900:68; — Smith, 1944:174.

Thalli up to 30 cm. tall and 10 cm. broad, distromatic, 47 μ thick, flaccid, violaceous pink, margins plicate but otherwise flat; base very broadly cordate; cells squarish in surface view and in irregular rows, average diameter, 17 μ; fruiting areas inconspicuous, narrow and marginal.

At Cape Arago on the rocks of the old jetty in Coos Bay (*John Queen 37*). Also taken from the stomach of the common fish, *Aspocottus bison.*

This is listed in the above references as "forma *cuneiformis.*"

Porphyra Thuretii Setchell & Dawson, *apud* Dawson, 1944:253; — Smith, 1944:171. *pl. 40, fig. 2.*

Porphyra leucosticta Hus (*non* Thuret) 1902:199. *pl. 20, figs. 1–3.*

Washed ashore in abundance onto the beach south of Chetco Cove once in July (*MD 6099*).

PORPHYRELLA Smith & Hollenberg, 1943

Porphyrella Gardneri Smith & Hollenberg, 1943:215. *figs. 13–14*; — Smith, 1944:175. *pl. 37, figs. 2–3.*

At Squaw Island, Middle Bay, Cape Blanco and cast ashore on the beach south of the Chetco River and probably throughout the intervening region. Usually on *Laminaria Andersonii* but occasionally on other kelps.

Some of the blades in the Chetco River material (*MD 6113*) are much larger than the type in the Dudley Herbarium (*306401*) being up to 20 cm. long and 8 cm. broad. The other Oregon collections are quite similar to the type.

NEMALIONALES

CHANTRANSIACEAE

ACROCHAETIUM Nägeli, 1862

Acrochaetium Desmarestiae Kylin, 1925:10. *figs. 4a–f.*

On *Desmarestia munda* at Cape Perpetua (*MD 6304*) and along the old jetty in Coos Bay (*MD 2698*).

Acrochaetium pacificum Kylin, 1925: 11. *figs. 4g–i.*

On *Polysiphonia* growing on *Nereocystis* attached to the wharf at Charleston (*MD 1930a*).

Acrochaetium variabile (Drew) Smith, 1944: 179.

On *Pterygophora* stipes at South Bay (*MD 2163*) and on *Pterochondria* at Charleston (*MD 1930b*).

Acrochaetium amphiroae (Drew) Papenfuss, 1945:312.
Rhodochorton amphiroae Drew, 1928:179. *pl. 40, figs. 34–37*; — Smith, 1944:183. *pl. 40, figs. 5–7.*

On the host, *Calliarthron regenerans*, throughout the range.

RHODOCHORTON Nägeli, 1862

Rhodochorton purpureum (Lightfoot) Rosenvinge, 1900:75; — Papenfuss, 1945:327.
Rhodochorton Rothii (Turton) Nägeli, 1861:121. *figs. 1 and 3*; — Smith, 1944:182. *pl. 41, figs. 1–2.*

At very high tide levels in a shaded cave at Brookings (*MD 6197*) in July. In Gardner's notebooks under number 2740, there is a record of this species with the note, "common in vicinity of lighthouse," Cape Arago. One collection (*MD 6036*) was made from a crustose alga growing on *Tegula funebralis* at South Bay in January.

The rhizoidal base penetrating the crustose alga (*MD 6036*) and giving rise to several long filaments; the filaments in turn unbranched except at the apex where a few alternate or unilateral few-celled corymbose branchlets give rise to tetrasporangia. Cells thick-walled, evenly cylindrical, about 17 (12–19) x 26 μ as a rule. Terminal cell of the filaments rounded. Tetrasporangia terminal on few-celled (1–2) clustered terminal branchlets, broadly obovate, up to 19 x 24 μ. Individual thalli are less than 2mm. high.

HELMINTHOCLADIACEAE

CUMAGLOIA Setchell & Gardner, 1917

Cumagloia Andersonii (Farlow) Setchell & Gardner, *in* Gardner, 1917:399; — Smith, 1944:189. *pl. 42, fig. 2.*

Throughout the range at HHLW or higher; usually hanging from the tops of boulders.

CHAETANGIACEAE

GLOIOPHLOEA J. Agardh, 1871

Gloiophloea confusa Setchell, 1914b:118; — Smith, 1944:190. *pl. 42, fig. 1.*

In large tidepools and on rocks between MLLW and LLLW levels. Found at Brookings in June and July (*MD 6148* and *2592*) and at Agate Beach in July (*MD 4761*).

GELIDIALES

GELIDIACEAE

GELIDIUM Lamouroux, 1813

Gelidium caloglossoides Howe, 1914:96. *pls. 34–35, fig. 7*; — Smith, 1944:194. *pl. 44, figs. 3–4.*

Forming low dark patches in crevices and on vertical sides of shaded rocks between HHLW and LHLW at Cape Arago.

Gelidium pusillum (Stackhouse) LeJolis, 1863:139; — Smith, 1944:195. *pl. 44, fig. 1.*

With *Ceramium Eatonianum* at Sunset Bay (*MD 4179*, December); and on large boulders and at tidepool margins between HHLW and LHLW at South Bay (*MD 4209*, January), and elsewhere on Cape Arago in the winter.

Gelidium pulchrum Gardner, 1927f:279. *pls. 50–53.*

In sand-filled tufts in tidepools from HHLW level downward; from Seal Rocks (*MD 2676*, July) south, but particularly abundant about Cape Arago.

Gelidium Coulteri Harvey, 1853:117; — Smith, 1944:196. *pl. 44, fig. 5.*

Forming hemispherical tufts between LHLW and MLLW levels southward from North Bay (*MD 2691*, July).

Gelidium sinicola Gardner, 1927f:278. *pl. 47, fig. 2.*

Two collections made in January at South Bay (*MD 4098* and *4099*). This species grew in soft irregular clumps of erect fronds just above LHLW in a tidepool. Except for its more bushy nature the collection (*MD 4098*) is quite like the type. Some of the shoots in the collection *MD 4099* possess flattened axes whereas the type material does not have them.

CRYPTONEMIALES

DUMONTIACEAE

CRYPTOSIPHONIA J. Agardh, 1876

Cryptosiphonia Woodii J. Agardh, 1876:251; — Smith, 1944:200. *pl. 45, fig. 2.*

Throughout the range at LHLW to MLLW tidal levels.

Tetrasporangia very irregularly cruciate, 70–75 x 115–140 μ.

PIKEA Harvey, 1853

Pikea pinnata Setchell, 1899, *in* Collins *et al.*, Phyc. Bor.-Amer. fasc. 13:648; — Smith, 1944:202. *pl. 45, fig. 3.*

Throughout the range between MLLW and LLHW.

While *Pikea pinnata* is certainly a distinct and regularly occurring form, if not a distinct species, most all of the material in the herbaria available is assignable to *P. nootkana* and the developmental sequence outlined under that species.

Pikea nootkana (Esper) comb. nov.

Fucus nootkanus Esper, 1802:30. *pl. 125* (heft 5).
Pikea californica Harvey, 1853:246 and 1858:131. *pl. 49, fig. B*; — Collins *et al.*, 1901, Phyc. Bor.-Amer. fasc. 18:897; — Smith, 1944:202. *pl. 46, fig. 3.*
Leptocladia conferta Setchell, 1912:252. *pl. 30*; — 1912, *in* Collins *et al.*, Phyc. Bor.-Amer. fasc. 37: 1848; — Smith, 1944:206. *pl. 46, figs. 4–5.*

Forming bright red hemispherical tufts between MLLW and LLLW throughout the range but particularly abundant along the southern Oregon coast.

It is clear from the figures that Esper gives for *Fucus nootkanus* and Harvey gives for *Pikea californica* that the two are the same. This being the case the earlier specific name of Esper must be used.

From at least some cells of the axial filament there are 4 quadrately disposed filaments. In age the thalli thicken below by multiplication of rhizoids growing down around and through the axial filament to produce a rounded main axis. In some cases the main axis becomes flattened and broadened, and in such forms the axial filament is compressed by the increased number of rhizoidal filaments. In these latter forms the burying of the lower portions of lateral branchlets increases the breadth of the flattened axis. With increased age and thickening of the major axes the pinnate arrangement of the lateral branchlets becomes irregular — apparently because of shedding of some of them. Other branchlets elongate and become rounded and thus produce false dichotomous branching in the thallus. Similar false dichotomies are found when the original main axis is broken off and pinnules below the break elongate. This growth form, rounded below but flattened and thin above, is the *Pikea californica* and *Fucus nootkanus* of Harvey and Esper respectively. The thin terminal portions may weather away or be destroyed during rough weather or winter seasons. Increased rhizoidal growth and increased production of the irregular dichotomies results in the growth forms known as *Leptocladia conferta*. All of these forms may be found throughout the range.

FARLOWIA J. Agardh, 1876

Farlowia mollis (Harvey & Bailey) Farlow & Setchell, 1901, *in* Collins *et al.*, Phyc. Bor.-Amer. fasc. 18:898; — Smith, 1944:204. *pl. 47, fig. 5.*
Farlowia crassa J. Agardh, 1876:262; — Smith, 1944:205. *pl. 46, fig. 1.*

Throughout the range between MLLW and LLLW.

There seems to be only one entity present north of central California

that can be placed in this genus. The species is very variable in regard to thickness and branching. The Port Orford record of *F. crassa*, listed by Smith, is based on a specimen from Collins' herbarium now in the University of California herbarium (number *266456*), and is *F. mollis*. An isotype (*E. Hall*, Oregon) of *F. crassa* and a co-type from San Diego, both in the same herbarium, show more irregular, sometimes unilateral branching from a rather thicker somewhat more asymmetric axis than typical for *F. mollis*, but these slight differences do not seem a justification for considering them to represent separate species.

DILSEA Stackhouse, 1809

Dilsea californica (J. Agardh) Schmitz, *in* Engler & Prantl, 1897:520; — Kylin, 1941:8.
Sarcophyllis californica J. Agardh, 1876:265.
Sarcophyllis californica forma *pygmeae* Setchell, 1897, *in* Collins *et al.*, Phyc. Bor.-Amer. fasc. 8:396.
Dilsea pygmaea Setchell, 1901:126.

Thalli blade-like with a medulla of more or less densely interwoven filaments and an outer cortex consisting of rows of small cells underlain by a subcortex of large granular cells; 180 — 360 μ thick; cystocarps forming first in the apical regions and the cells of the young carposporophyte appearing like gland cells in surface view and like clusters of gland cells in section, with no ostiole; gland cells if truly present at all, irregular in appearance and certainly entirely absent in most of our material; not slimy to the touch when fresh; tending to dry dark colored on herbarium sheets.

Throughout the range above the MLLW level and frequently in dense stands with the blades split irregularly along irregularly incurved lines. *MD 6198*, Harris State Park in July, compares well with the Phyc. Bor.-Amer. number cited, as does *MD 6184* from Otter Point.

Kylin finds the fertile type material (herbarium of J. Agardh number *35900*, collected by E. Hall in Oregon and sent to Agardh by Farlow) to have the reproductory structures characteristic of the *Dumontiaceae*. The tetraspores are produced in a mass from the large subcortical cells and form an extensive layer between the cortex and the medulla. When dried material is resoaked the cortical layers have a strong tendency to separate from the medulla through this mass of subcortical cells. See page 176 for vegetative distinction from *Schizymenia pacifica* Kylin.

CONSTANTINEA Postels & Ruprecht, 1840

Constantinea simplex Setchell, 1901:127; — Smith, 1944:207. *pl. 47, fig. 6.*

Throughout the range in exposed places below LHLW.

In especially favorable well-aerated crevices or exposed ledges this species often forms dense stands of small thalli. Because of their brownish color and small size these at one time were tentatively considered by the author as a different species from the usual large red form.

GLOIOSIPHONIACEAE

GLOIOSIPHONIA Carmichael, 1833

Gloiosiphonia verticillaris Farlow, 1889:3. *pl. 88, figs. 5–6, 9–10*; — Smith, 1944. 209. *pl. 47, fig. 1.*

Common in the early summer months on the sides of large boulders between the HHLW and LHLW levels. In the Brookings area and at Rouge River Reef (Otter Point, *MD 6174*). Also collected once by O. R. O'Neal at Sunset Bay.

?Gloiosiphonia californica (Farlow) J. Agardh, 1885:10; — Smith, 1944: 209. *pl. 47, fig. 2.*

There is one collection made by Gilbert Shearer on the old jetty in Coos Bay in June (*MD 2718*) that is questionably referred here. Since there seem to be two opposite lateral filaments arising from each cell of the single axial filament, or in many cases only one, this sterile specimen may be a form of *Cryptosiphonia.* However, the texture and coloration is like that of *G. californica.*

GLOIOPELTIS J. Agardh, 1842

Gloiopeltis furcata (Postels & Ruprecht) J. Agardh, 1851:235.

PLATE 11, FIG. B

Thalli terete, dichotomously divided, up to 6 cm. tall with the branches largest (up to 3 mm.) about two-thirds of the distance from the base to the apex of the main axis; thalli tapered to a short filiform stipe below and to slender, usually divaricate tips above; texture tough and gelatinous; surface smooth when sterile, and usually remaining so when dried; branches with a large continuous cavity and the cortex consequently thin.

Throughout the range but most conspicuous at the southern end of the state.

In the Brookings area, where this is most abundant and best developed as to size, this is the conspicuous indicator, at least during the early summer months, of the highest regularly occurring algal zone. This zone extends upwards from the LHHW level. It is exceeded only by the irregularly occurring *Porphyra schizophylla, Rhodochorton violaceum,* and *Prasiola meridionalis* in our range. In the lower portion of the zone occupied by *G. furcata* it may intermingle with *Endocladia, Gigartina,* and *Pelvetiopsis,* but on smooth surfaces of regular contour it is strictly above them.

ENDOCLADIACEAE

ENDOCLADIA J. Agardh, 1841

Endocladia muricata (Harvey) J. Agardh, 1847:10; — Smith, 1944:211. *pl. 47, figs. 3–4.*

This is the dominant member of the association between the HHLW and LLHW tide levels. Doty (1946, p. 321–322, and fig. 2 and 6) probably should have consistently given this vertical distribution. Common throughout the range.

SQUAMARIACEAE

PEYSSONELIA Decaisne, 1841

Peyssonelia pacifica Kylin, 1925:25. *fig. 12b–d, 13*; — Smith, 1944:212. *pl. 48, fig. 3.*

Throughout the range from LHLW levels downward.

Forming bright red patches up to 15 by 30 cm. These patches at times confluent. Bright red, rough surfaced and thin at first, but becoming dark red and more smooth at maturity; drying red.

RHODODERMIS Crouan, 1852

Rhododermis Georgii (Batters) Collins, 1906:106.
Rhodophysema Georgii Batters, 1900:377. *pl. 414. figs. 8–13.*

In Gardner's notebooks under number *2720* this species is listed as "growing on narrow eel grass in tidepool, middle littoral zone. Shore acres south of Cape Arago Lighthouse. . . ." In the same place there is evidence that a considerable amount of material was collected and preserved and studied, but this material was not found.

HILDENBRANDIA Nardo, 1834

Hildenbrandia occidentalis Setchell, *apud* Gardner, 1917:393. *pl. 33, fig. 4*; — Smith, 1944:125. *pl. 49, fig. 4.*

Throughout the range, above the LLHW level.

CRUORIACEAE

PETROCELIS J. Agardh, 1852

Petrocelis franciscana Setchell & Gardner, *apud* Gardner, 1917:391. *pl. 33, fig. 1*; — Smith, 1944:217. *pl. 48, fig. 1.*

Throughout the range on rocks between LHLW and LLHW levels. Forming black shiny irregularly shaped areas of indefinite extent. Tetrasporangia produced in January (*MD 4119*, Middle Bay); about 20 μ in diameter.

CORALLINACEAE

CORALLINA Linnaeus, 1758

Corallina densa (Collins) comb. nov.
Corallina gracilis var. *densa* Collins, 1906:112; — Smith, 1944:230. *pl. 50, figs. 3–5.*

Throughout the range as far north as Cape Arago where it is common at all stations below LHLW. In Gardner's notes (number *2719*) *C. gracilis* var. (forma) *multiramosa* is recorded from Cape Arago.

Corallina chilensis Decaisne, *apud* Harvey, 1847:103; — Smith, 1944:230. *pl. 51, fig. 4.*

Throughout the range in a wide variety of form.

JOCULATOR Manza, 1937

Joculator delicatulus sp. nov.

Frondes erectae, usque ad 2 cm. altitudine; ramificatio irregulariter opposita, apici-

bus ramorum amiorum saepe antenniferis; intergenicula cuneata, 1 mm. longitudine per 2 ad 3 mm. latitudine, in parte ramorum superiore manifeste complanata, in basibus ramorum angustiora rotundatioraque, supra fere omnia ramusculum simplicem, aut ramulum compositum axi parenti similem, aut, praecipue ad basim, ramulos antenniferos, rhizoidiformes, teretes ferentia; conceptacula ad superficiem intergenicularem complanatam saepe restricta, conceptacula terminalia, autem, in apicibus ramorum antenniferorum ordinariorumque et saepe in ramusculis simplicibus lateralibus inveniuntur.

Fronds erect, up to 2 cm. tall; branching irregularly opposite and with the apices of major branches often antenniferous; intergenicula cuneate, 1 mm. long by 2 — 3 mm. broad, those in upper portion of branches conspicuously flattened, narrower and more rounded at the bases of branches, almost every one above bearing either a simple ramule (*i.e.*, a terminal intergeniculum borne on the upper margin of the parent intergeniculum near the terete axial portion of this latter and separated from it by just one geniculum), or a compound branchlet similar to the parent axis, or, especially near the base, terete antenniferous rhizoid-like branchlets; conceptacles often restricted to one flattened surface; narrow intergenicula usually with two conceptacles and these on the wing surfaces, and on very broad intergenicula often a third conceptacle appears on the terete axial portion; terminal conceptacles are found at the apices of both antenniferous and normal branches and often on the simple lateral ramules.

Known from three collections on Cape Arago (*MD 6353*, ***TYPE:*** *MD 4142* [Dudley Herbarium 306911], and *MD 6355*) in January. This alga was growing in association with *Bossea plumosa* in rather high (above LHLW) shallow tidepools.

This Oregon species is somewhat lower in stature, the intergenicula are distinctly broader in proportion, and they form a more closely jointed frond than Manza's type material of *J. pinnatifolius*. The frond of *J. delicatulus* overall is much more delicate.

BOSSEA Manza, 1937

Bossea plumosa Manza, 1937a:46; — Manza, 1940:303. *pl. 12, figs. 1–2*; — Smith, 1944:233. *pl. 51, fig. 1.*

Common throughout the range south of Cape Arago. *MD 2712* (Cape Blanco) is identical in all superficial characteristics with the type in the the University of California herbarium as number *545710.*

Bossea frondifera Manza, 1937b:562; — Manza, 1940:306. *pl. 14.*

Common on rocks between the LHLW and MLLW levels at Cape Arago. *MD 1848* from Sunset Bay is the same as the type in the University of California herbarium as number *545757.*

Bossea Orbigniana (Decaisne) Manza, 1937b:563.

Only three collections are known from Oregon; each different from the rest. *MD 4117*, collected at Middle Bay, seems to be similar to the University of California number *296059*, bearing the annotation, "type of Manza." In Gardner's notebooks under the number *2787, Amphiroa tuber-*

culata f. *Orbigniana* is recorded from Sunset Bay. This Gardner collection is similar to *MD 2725* from Oceanside (Cape Mears).

Differing from *B. Gardneri* in having two conceptacles on each surface of fertile intergenicula and in having these close together, or very near the midrib, and in the more slender nature of the less conspicuously dichotomous fronds. *B. Gardneri* has 3 — 6 conceptacles on the surfaces of the fertile intergenicula and the upper angles of the intergenicular wings are more rounded than in *B. Orbigniana*.

Bossea Gardneri Manza, 1937b:563; — Manza, 1940:306. *pl. 15.*

Two collections: one (*MD 2612*) from Cape Blanco in June; the other from Brookings in December (*MD 4177*). These are quite similar to specimens of *B. californica* in the University of California herbarium.

Bossea californica (Decaisne) Manza, 1937b: 561; — Manza, 1940:305; — Smith, 1944:233. *pl. 51, fig. 2.*

In Gardner's notebooks, under number *2717*, there is listed *Amphiroa tuberculata* f. *californica* from near the Cape Arago lighthouse. This specimen has not been seen.

Bossea corymbifera Manza, 1937b:562; — Manza, 1940:305. *pl. 13*; — Smith, 1944: 234. *pl. 52, fig. 3.*

Charlotte L. Doty 1895 (North Bay, July) and *MD 6354* (sloping wet tidepool shore, Sunset Bay, July) are finely branched, unusually flat and thin fronds that seem nearer this species than any other described by Manza. The North Bay collection is very much like some specimens of Manza's at the University of California, but still not like the type.

CALLIARTHRON Manza, 1937

Calliarthron regenerans Manza, 1937b:565; — Manza, 1940:269. *pl. 4, figs. 1–4.*

At Cape Arago and southward throughout the range. Other species have been collected in sterile condition or in forms that were not definitely identifiable.

MELOBESIA Lamouroux, 1812

Melobesia mediocris (Foslie) Setchell & Mason, 1943:95; — Smith, 1944:219. *pl. 49, fig. 1.*

Abundant on *Phyllospadix* at Sunset Bay (*MD 1840*) in July, probably throughout the range since it has been observed on its host elsewhere.

Melobesia marginata Setchell & Foslie, *in* Foslie, 1902:10; — Smith, 1944:219. *pl. 49, fig. 2; pl. 50, fig. 1.*

Observed throughout the range but identification confirmed by examination of sections in two cases only, on *Laurencia spectabilis* and *Botryoglossum Farlowianum* at South Bay in December (*MD 4102*) and on *Plocamium pacificum* at North Bay (*MD 4984*) in July.

LITHOTHAMNION Philippi, 1837

Lithothamnion conchatum Setchell & Foslie, *apud* Foslie, 1902:6; — Smith, 1944: 222. *pl. 50, fig. 2.*

Along with the next species sparingly throughout the range on species of *Calliarthron* and on *Corallina densa.*

Lithothamnion parcum Setchell & Foslie, *apud* Foslie, 1907b:14; — Smith, 1944: 223.

Throughout the range on *Calliarthron* and *Corallina.*

Lithothamnion lamellatum Setchell & Foslie, *apud* Foslie, 1903:4; — Smith, 1944: 222.

Throughout the range as far north as Boiler Bay (*MD 2646*) on rocks below MLLW.

Lithothamnion pacificum Foslie, 1906:10; — Smith, 1944:221. *pl. 49, fig. 3.*

Throughout the range tetrasporic in January (*MD 4154* and *4153*, South Bay) and also during the summer. A form smoother than usual was found on the shell of *Searlesia dira.*

Other *Lithothamnion*-like material collected and sectioned has proven to be either sterile or lacking tetraspores. One of these unidentifiable entities is very similar to *L. californicum*, and is to be found at least throughout the southern half of the range.

FOSLIELLA Howe, 1920

Fosliella dispar (Foslie) G. M. Smith, 1944:225. *pl. 50, fig. 6.*

Common on both species of *Ahnfeltia* in the Brookings area.

Other members of this genus have been collected on various uncalcified red algae but the specimens sectioned, with one exception, could not be identified with certainty because they were not tetrasporic. One collection (*MD 2184*, from lighthouse reef, Cape Arago) seems to be an undescribed species on *Phyllospadix.*

LITHOPHYLLUM Philippi, 1837

Lithophyllum neofarlowii Setchell & Mason, 1943:95; — Smith, 1944:228.

Common south of Cape Arago (*e.g.*, *MD 4155*, tetrasporic in January; *4164* and *4163*).

?Lithophyllum grumosum Foslie, 1909:20; — Smith, 1944:227.

Sterile or sexual material that seems to be this species has been collected several times at Cape Arago.

GRATELOUPIACEAE

GRATELOUPIA C. Agardh, 1822

Grateloupia californica Kylin, 1941:9. *pl. 1, figs. 1–2*; — Smith, 1944:239. *pl. 55, figs. 1–2.*

Throughout the range, with more northern forms tending to be smaller and more proliferous than the southern collections.

In high-lying tidepools there is a form (*MD 2628*, Seal Rocks) that may prove specifically distinct from *G. californica*. It is very proliferous, thick, slimy, and has a strong tendency to lose the red color that normally masks the chlorophylls.

Grateloupia maxima (Gardner) Kylin, 1941:10

Grateloupia Cutleriae forma *maxima* Gardner, 1911, *in* Collins *et al.*, Phyc. Bor.-Amer. fasc. E:124.

At the University of California there is a collection of this species by Gardner (*2687a*) labeled, "Sunset Beach south of Cape Arago." This is very similar to the material distributed in the Phyc. Bor.-Amer. as cited above. Two other collections from Oregon are also considered this species. One was made at Middle Bay (*O'Neal 351b*); the other was found cast ashore at Chetco Cove (*MD 6102a, 6102c*).

Grateloupia Setchellii Kylin, 1941:10. *pl. 1, fig. 4*; *text fig. 2d*; — Smith, 1944:240. *pl. 55, fig. 3.*

Thallus pinnately branched, 15 cm. tall and rarely 1 cm. broad, pinnules often pinnate at their bases; resoaked specimens up to 200 μ thick with cortex in such a section about 28 μ thick, of 1 to 2 cells the outermost of which is elongated vertically, the weakly developed medulla about 45 μ thick and of 3–5 filaments, with a layer of 2 or 3 larger subcortical cells between each about 25 μ thick; bright red when fresh and not as soft or slimy as usual in other Pacific Coast species; tetrasporangia scattered and broadly elliptical, about 35 x 28 μ, cruciately divided, superficial in the cortex but exceeding this inwardly; cystocarps and tetrasporangia borne principally on the lateral pinnules but also on the main axis.

Known in Oregon only from Otter Point (*MD 6173*, July) where it is common just beneath *Laminaria Sinclairii* where this latter appears (displaced from its normal habitat) on the vertical surfaces of large rocks protruding from the sand in exposed localities between MLLW and LLLW. Both tetrasporic and cystocarpic individuals were collected.

CRYPTONEMIA J. Agardh, 1842

KEY TO THE SPECIES OF *CRYPTONEMIA* TO BE FOUND ON THE OREGON COAST

1. Fertile fronds over 120 μ in thickness; medulla of 5–8 or more parallel filaments ..... **C. obovata**

1. Fertile fronds less than 120 μ in thickness; medulla of 2–5 loosely interwoven filaments 2

2. Thalli small (up to 7 x 5 cm.), symmetrical, ovate, with a stipe-like base; medulla of 2–3 filaments (therefore very loose in structure) .... **C. ovalifolia**

2. Thalli larger (up to 10 x 8 cm.), asymmetrical or obovate, no stipe-like base, never over 70 μ thick; medulla of 3–5 filaments (therefore rather dense in structure) ..... **C. borealis**

Cryptonemia obovata J. Agardh, 1876:681; — Kylin, 1925:19. *fig. 8a*; — Kylin, 1941:11. *pl. 3, fig. 8.*

On rocks between MLLW and LLLW at Otter Crest (*MD 6182*, sterile, July).

Cryptonemia ovalifolia Kylin, 1941: 11. *pl. 3, fig. 9*; — Smith, 1944:241. *pl. 54, figs. 2–3.*

Cystocarpic and male thalli (*MD 1993* and *O'Neal 262*) have been collected on the lateral walls of a large tidepool at South Bay in July. While small this material compares well with the isotype in the Dudley Herbarium (number *306388*).

Cryptonemia borealis Kylin, 1925:19. *figs. 8b–e, 9.*

For a number of years this species has been observed (and collected, *e.g., MD 2573*) growing on the same flat rock at the MLLW tide level in the entrance to a cave on Coos Head.

AEODES J. Agardh, 1876

Aeodes Gardneri Kylin, 1925:17. *fig. 7*; — Smith, 1944:242. *pl. 54, figs. 4–5.*

Frequently cast ashore and occasionally collected from rocks submerged in the larger tidepools on Cape Arago.

ZANARDINULA De Toni, 1936

Zanardinula Andersoniana (J. Agardh) Papenfuss, 1944:342.

Prionitis Andersoniana Eaton *ex* J. Agardh, 1876:159; — 1898, *in* Collins *et al.*, Phyc. Bor.-Amer. fasc. 9:448; — 1877, *in* Farlow *et al.*, Alg. Exsicc. Amer.-Bor. No. 24; — Smith, 1944:246. *pl. 57, fig. 3.*

Throughout the range about the bases of rocks buried in sand between the MLLW and LLLW levels. Forms such as the Phyc. Bor.-Amer. specimens cited are transitional toward the thin-bladed condition of some forms of *Z. lanceolata.*

Zanardinula Lyallii (Harvey) De Toni, 1936:7.

Prionitis Lyallii Harvey, 1862:173; — Smith, 1944:247. *pl. 56, fig. 3.*

Common between the LHLW and MLLW levels but growing higher where the rocks are continually moist. Often found almost completely filling tidepools at levels up to 10 feet above MLLW. Throughout the range in a multiplicity of forms.

Most of the Oregon material is of forms that have more linear, narrower branches than the form figured by Smith. When this species grows in high-lying tidepools it is often very brown in color and flaccid.

Zanardinula lanceolata (Harvey) De Toni, 1936:7.

Prionitis lanceolata Harvey, 1853:197. *pl. 27, fig. A*; — Smith, 1944: 246. *pl. 57, fig. 1.*

Common throughout the range.

Zanardinula filiformis (Kylin) Papenfuss, 1944: 342

Prionitis filiformis Smith, 1944:244. *pl. 56, fig. 1.*

Prionitis filiformis Kylin, 1941:13.

Prionitis angusta Setchell, 1899, *in* Collins *et al.*, Phyc. Bor.-Amer. fasc. A:24 (*non* Okamura).

Prionitis lanceolata β angusta Harvey, 1853:197.

PLATE 13, FIG. A

Thalli linear, up to 35 cm. tall, lower parts terete about 1 mm. in diameter, ultimate branchlets flattened but still very narrow and linear, usually less than 1.5 mm. broad but in short robust specimens occasionally up to 2.0 mm. broad; branching in upper portion of major branches appears irregularly dichotomous due to the elongation of lateral pinnules; pinnate marginal proliferations if present short (less than 3 mm. long); cystocarps present in the pinnules; thalli bright red, growing in more or less hemispherical tufts.

The two uppermost fronds show in Plate 13, Fig. A are of typical form; the lowermost is the broadest form and nearest approach in form to the next species.

Throughout the range at least south of Squaw Creek on MLLW to LLLW rocks. *MD 2295* (Dudley Herbarium *306913*), Squaw Island, was cystocarpic in July.

Without an authentic specimen that can be chosen as a lectotype, it cannot be established which form Harvey had in mind by his *β angusta*. From his description, "much more slender, forked, with few and nearly naked branches," it might very well be a variety of *Z. lanceolata* or *Z. Kylinii*.

Zanardinula Kylinii nom. nov.

Zanardinula linearis (Kylin) Papenfuss, 1944:342. (*nom. nud.*)
Prionitis linearis Smith, 1944:245. *pl. 56, fig. 2.* (*nom. nud.*)
Prionitis linearis Kylin, 1941:12. (*nom. nud.*)
Prionitis lanceolata Collins, Holden & Setchell, 1896, *in* Collins *et al.*, Phyc. Bor.-Amer. fasc. 4:199b.

PLATE 12, FIG. B

Thalli ubique lineares, minimum usque ad 11 cm. altitudine atque usque ad 1.5 mm. latitudine, stipite, aut stipite cum dichotomia prima, plus quam dimidium altitudinis totius efficiente; pars solum inferior stipitis erecti non-ramosi teres, reliquus stipes et prima vel duae dichotomiae compressae, reliquae duae tresve dichotomiae manifeste complanatae; dichotomiae regulares ad aut prope apicem crescentem videntur; proliferationes laterales, breves, simplices dichotomaeve, interdum in lateribus dichotomiarum inferiorum, raro in stipite adsunt, hae rarius conspicuae aut plus quam 5 mm. longitudine sunt.

Thalli linear throughout, up to 11 cm. tall and up to 1.5 mm. broad, over half the height in stipe, or stipe and the first dichotomy; only the lower part of the erect unbranched stipe terete, the remainder of the stipe and the first one or two dichotomies compressed, the remaining two or three dichotomies flattened; the regular dichotomies appear at or near the growing apex; short simple or dichotomous lateral proliferations may be present along the sides of the lower dichotomies or rarely on the stipe; these are only rarely conspicuous or over 5 mm. long.

TYPE: *Charlotte L. Doty 2440* (Dudley Herbarium *307369*), forming hemispherical tufts between the MLLW and LLLW tide levels at Sunset Bay, Cape Arago, Coos County, Oregon, July 30, 1940. **COTYPE**: *MD 6341*, collected by John Merkle at Three Rox near Neskowin, Tillamook County, in January.

Oregon specimens are, for the most part, more slender and have fewer pinnate branchlets than the *Phycotheca* specimens cited, but seem to represent the same species. This species seems to differ from Dawson's (1944: 283. *pl. 67, fig. 2*) *Prionitis mexicana* in being coarser and in having fewer long pinnate branches.

This entity though long separated from other species of this genus has never been legitimately described. Such situations as this are embarrassing for all parties concerned, when following the rules of nomenclature dictates the introduction of a new name, as is necessary in this instance.

LOBOCOLAX Howe, 1914

Lobocolax deformans Howe, 1914:91; — Smith, 1944:248. *pl. 57, fig. 4.*

Possibly throughout the range of the host, *Prionitis lanceolata,* but no certainly identifiable fertile material known from Oregon.

CALLYMENIACEAE

CALLOPHYLLIS Kützing, 1843

Callophyllis flabellulata Harvey, 1862:171; — Kylin, 1925:34. *fig. 16* (type specimen figured).
Callophyllis marginifructa Setchell, 1923b:398; — Smith, 1944:250. *figs. 3–4.*
Callophyllis crassifolia Setchell, 1923b:398; — Smith, 1944:250.

At all stations below MLLW usually washed in fruiting in the summer and not seen during the winter months.

C. flabellulata is supposed to differ from *C. marginifructa,* which has the cystocarps all along the margins, in having the cystocarps restricted to the terminal segments. From the comparison of many specimens at the Universities of Oregon and California, and at Stanford University, it is concluded that in thicker forms growing in deep water the cystocarps are produced first on the terminal branchlets and later, or from the first in narrow and thin forms, all along the margins. Kylin (1941:16) expresses doubt as to any constant difference between *C. flabellulata* and *C. marginifructa. C. crassifolia* as collected in quantity in the Monterey region of California seems to be but a very thick form of the above species. The types, as figured by Kylin, of *C. flabellulata,* and as deposited at the University of California, of *C. marginifructa* and *C. crassifolia,* fit well into the gamut of variation displayed by the available Oregon and other west coast specimens.

Callophyllis megalocarpa Setchell & Swezy, *apud* Setchell, 1923b:401; — Smith, 1944:251. *pl. 59, fig. 1.*

Throughout the range at the bottoms of tidepools, and cast ashore in small numbers during the summer months (*e.g., MD 2396,* Squaw Island, cystocarpic).

While the Oregon material is of lower stature (up to 12 cm. tall) and seems to be less harsh or crisp, it compares well with young specimens from the Monterey Peninsula and elsewhere.

Callophyllis crenulata Setchell, 1923b:400; — Smith, 1944:250. *pl. 58, fig. 1.*

Common south of Cape Arago and probably throughout the range, washed in during the summer (often as an epiphyte).

Material collected at Cape Blanco (*MD 2517a*, in July) and a few miles south of the mouth of the Chetco River (*MD 6104a*) looks very much like the type at the University of California.

Callophyllis heanophylla Setchell, 1923b:401; — Kylin, 1925:34. *fig. 17.*

One collection (*MD 4975*) North Bay, cystocarpic in July.

This species is distinct from other similarly flabellately branched species in having rather small cystocarps (usually 0.5 mm. in diameter and probably never over 0.75 mm.) scattered over the surface. The thalli are usually less than 7 cm. tall and none are over 12 cm. tall.

Callophyllis violacea J. Agardh, 1884:34; — Kylin, 1941:16. *pl. 5, fig. 13.*

Growing with and below *Lessoniopsis* at MLLW to at least as low as LLLW in characteristic tufts on crustose corallines and probably directly on the rock substratum. *MD 2530a*, Cape Blanco, is cystocarpic; the northernmost Oregon collection (*MD 2636*) is from Boiler Bay; both were collected in July.

Callophyllis pinnata Setchell & Swezy, *apud* Setchell, 1923b:400; — Smith, 1944:251. *pl. 58, fig. 2.*

Common at least south from Cape Arago. Only washed in material has been obtained from Oregon, but on the Monterey Peninsula, California, it is rather common between the MLLW and LLLW levels and lower.

Resembling *C. obtusifolia*, and usually identified with that species, however, it differs in that it is a much broader often digitately branched alga and is larger in all respects. Only the older thalli have the characteristic stalked pinnules on the lower margins. Sometimes the pinnules may be very thin and arise from a very much darkened and thickened fragment of the parent blade. Next to the *flabellulata*-group this is the form most frequently collected.

There are four collections known to the author (Sanborn collection from Cape Arago in the University of California herbarium; *O'Neal 208*, North Bay; *Eustice and Doty 2100*, washed in at Lighthouse Beach; and *C. L. Doty 2516*, Cape Blanco) which seem to be distinct from *C. pinnata* because of their extreme pinnation. However, since they are not fruiting (*i.e.*, not cystocarpic) and the pinnules clearly arise from an eroded parent blade, identification of them is uncertain. Perhaps it is only an unusually proliferous form of this species.

Callophyllis edentata Kylin, 1925:34. *fig. 18.*

Locally abundant in moderate to large-sized tidepools on Cape Arago.

Callophyllis oregona sp. nov.

PLATE 11, FIG. A

Thallus usque ad 12 cm. altitudine, alterne aut dichotome irregulariter ramosus; rami 5 ad 8 mm. latitudine, divaricati, marginibus levibus; cystocarpi admodum intra

margines partium frondis mediarum vel latissimarum primum enascentes; ostiola 2 vel 3 (1 ad 5) ad superficiem laminae marginisque perpendiculariter disposita.

Thallus up to 12 cm. tall, irregularly alternately or appearing at times dichotomously branched; branches 5 — 8 mm. broad, divaricate, margins smooth; tips divided into a few (2 — 4) short fine blunt processes; cystocarps almost all with their 2 or 3 (1 — 5) ostioles directed at right angles to the surface of the blade and just within the margins themselves (48 out of first 50 counted), appearing along the margins in the middle or broadest portion of the frond.

Known only from material washed ashore at North Bay (*MD 5063*, July) and at Brookings (*O'Neal 404* and the **TYPE:** *MD 2594* [Dudley Herbarium *306925*], both cystocarpic, and collected on June 24, 1941).

PUGETIA Kylin, 1925

Pugetia fragilissima Kylin, 1925:30. *fig. 14.*
Pugetia firma Kylin, 1941:15. *pl. 4, fig. 12*; — Smith, 1944:254. *pl. 60, fig. 1.*

Throughout the range between MLLW and LLLW levels and probably lower. Pendant from overhanging rocks or on shaded sides of vertical rocks.

P. fragilissima and *P. firma* have been considered distinct species because of thickness, size of blades, and the number of cortical cells. The same holds for material collected on the Monterey Peninsula in California. Some thin specimens agreeing well with the description of *P. fragilissima* and other thick (up to 1.5 mm.) specimens agreeing with the description of *P. firma*; still other specimens are intermediate between the two. The specimens collected in Oregon intergrade so completely in these respects that the two cannot be considered distinct.

GIGARTINALES

NEMASTOMACEAE

SCHIZYMENIA J. Agardh, 1851

Schizymenia pacifica Kylin, 1932:10; — Smith, 1944:258. *pl. 60, fig. 4*; *pl. 61, fig. 1*; — Collins *et al.*, 1897, Phyc. Bor.-Amer. fasc. 8:395.
Turnerella pacifica Kylin, 1925:21. *fig. 11.*
Sarcophyllis californica Setchell & Gardner, 1903:354 (*non* J. Agardh).

Throughout the range below the MLLW level.

Although the blades of this alga are often irregularly split, they differ from those of *Dilsea californica* (see page 165) in not being divided into linear curved segments. Our species of *Schizymenia* likewise differs from *Dilsea* in having regularly present an abundance of gland cells (8–15 x 20–60μ), a small ostiole over each cystocarp, in being as a rule slimy to the touch when fresh, in lacking a subcortical layer of large granular cells, and in usually drying light colored on herbarium sheets.

SOLERIACEAE

OPUNTIELLA Kylin, 1925

Opuntiella californica (Farlow) Kylin, 1925:23. *fig. 11*; —Smith, 1944:262. *pl. 61, fig. 2.*

Throughout the range on rocks in well-aerated water; between MLLW and LLLW levels.

AGARDHIELLA Schmitz, 1896

Though the alga *Agardhiella Coulteri* is said to be common along the Pacific Coast from British Columbia to southern California, no specimens have been found along the Oregon Coast (nor are there specimens in the University of California herbarium from there) though a continued painstaking search has been made for it. Since this alga does seem to be present in Puget Sound the range should be given as Puget Sound *and* central California.

PLOCAMIACEAE

PLOCAMIUM Lamouroux, 1813

Plocamium oregonum sp. nov.

PLATE 14, FIG. B

Thalli usque ad 13 cm. altitudine obscuro-rubri, nisi ad cacumina; axes primarii complanati, 1 mm. vel minus latitudine, rami primarii supra robustores facti quam axis primarius infra; ramuli ad apicem robustiores facti ut partes frondium inferiores admodum macrae saepe videantur; rami primarii ad basim longitudine aucti.

Thalli up to 13 cm. tall, dull red in color except at the tips; main axes flattened, 1 mm. or less broad; major branches in upper part of thallus corymbose, of greater diameter than lower portion of the main axis; secondary branches increasing in size toward the apex of the thallus; the lower parts of major branches often appearing barren, because of the smaller branchlets there.

TYPE: *MD 6151* (Dudley Herbarium *306916*), in hemispherical tufts between MLLW and LLLW, Harris State Park, Brookings, Curry County, Oregon, July 6, 1944. *F. P. Sipe 613*, just south of Cape Perpetua, Lincoln County, Oregon, July.

The following specimens in the *P. pacificum* folder in the University of California herbarium may be assigned to this species: *651501*, "abundant in tufts on stones in lower littoral pools"; *276451* (and in the Dudley Herbarium *306914*) (*Gardner 3047*), Tomales Bay, California; *651633* (and in the Dudley Herbarium *306915*) (*Gardner 7837*), *276358*, *276349*, *276383* (*H. E. Parks*) Trinidad, California; *276502* (*Gardner 2683*) Sunset Bay; *266338* (*Mrs. R. W. Summers 1543*) Yaquina. In addition the author has two collections, *John Queen 49* and *MD 2406*, both from Squaw Island.

The type has been compared with a specimen of *P. oviforme* Okamura deposited by Okamura in the University of California herbarium (*418240*)

and found to be quite different. As compared with other Pacific Coast species of *Plocamium* it is taller than either *P. violaceum* or *P. tenue* and more slender, and less densely branched than *P. pacificum*.

Plocamium tenue Kylin, 1925:43. *figs. 24c-d.*

On vertical rocks between MLLW and HHLW at South Bay (*MD 4104*) in January, and along the north shore of Chetco Cove (*MD 6110*) in July.

To be distinguished from *P. violaceum* by the abundance of branching, the smaller less conspicuous simple branches less than 4 mm. in length, and by the smaller diameter of the main axes which are rarely over 0.5 mm. in diameter. Usually it grows in rather dense stands whereas *P. violaceum* is almost always in isolated tufts. *P. violaceum* usually has a simple erect axis, or is branched right at the base but without long lateral branchlets. The simple branchlets of *P. violaceum* are usually over 4 mm. long at maturity, and the main axis generally becomes 0.75 to 1.0 mm. in diameter at maturity.

Plocamium violaceum Farlow, 1877:240; — Smith, 1944:264. *pl. 62, fig. 2.*

Between MLLW and HHLW on Cape Arago (*e.g., C. L. Doty 2450*).

The Oregon specimens referred to this species are short in stature and finely branched and may more truly be a form of *P. tenue*.

Plocamium pacificum Kylin, 1925:42. *fig. 24b*; — Smith, 1944:264 *pl. 62, fig. 1.*

Throughout the range between MLLW and LLLW.

PLOCAMIOCOLAX Setchell, 1923

Plocamiocolax pulvinata Setchell, 1923a:396; — Smith, 1944:265. *pl. 62, fig. 3.*

This species is recorded in Gardner's notes under number *2694* as from Sunset Beach, Cape Arago.

GRACILARIACEAE

GRACILARIA Greville, 1830

Gracilaria Sjöstedtii Kylin, 1930a:55; — Smith, 1944:267. *pl. 63, fig. 4.*

Throughout the range on sand-covered rocks between MLLW and LLLW.

No attempt has been made to distinguish specimens that might be referred to *G. confervoides* instead of the present species. However specimens collected at Fossil Point in Coos Bay (*MD 1934*) have a cortex of 5 to 6 cells in thickness and lack filaments between the cystocarp wall and the carposporophytic tissues.

GRACILARIOPHILA Setchell & Wilson, *apud* Wilson, 1910

Gracilariophila oryzoides Setchell & Wilson, *apud* Wilson, 1910:81. *pl. 12–13*; — Smith, 1944:268. *pl. 63, fig. 1.*

Parasitic on *Gracilaria Sjöstedtii* in Coos Bay and at Lighthouse Beach.

PHYLLOPHORACEAE

AHNFELTIA Fries, 1835

Ahnfeltia concinna J. Agardh, 1847:12; — Setchell & Gardner, 1903:305.
Ahnfeltia Gigartinoides J. Agardh, 1847:12; — Smith, 1944:272. *pl. 64, fig. 1.*

Locally abundant throughout the range between MLLW and LLLW, usually on boulders partially buried in sand. Nemathecoid swellings are present on the specimens collected during the summer.

Setchell & Gardner say, "We have united under this name the *A. concinna* and the *A. Gigartinoides* of J. G. Agardh." Since they are the first authors to treat one of them as a definite synonym of the other they have the right to choose either, since these two species were published at the same time. Therefore, *A. concinna* must be used in preference to *A. Gigartinoides* unless these are treated as two different entities.

Ahnfeltia plicata (Hudson) Fries, 1835:310; — Smith, 1944:271. *pl. 64, figs. 2–3.*

Common throughout the range on rocks between MLLW and LLLW and often abundant in tidepools, especially those that are crack-like in nature and partially sand-filled. The specimens collected during the summer have the characteristic nemathecoid swellings of this genus.

GYMNOGONGRUS Martius, 1833

Gymnogongrus linearis (Turner) J. Agardh, 1851:325; — Smith, 1944:274. *pl. 65, fig. 3.*

Throughout the range south of Cape Perpetua, where it was collected by F. P. Sipe (*13, 19*) between the MLLW and LLLW levels on rocks.

Gymnogongrus leptophyllus J. Agardh, 1876:211; — Smith, 1944:273. *pl. 65, fig. 1.*

Cast ashore at Lighthouse Beach in July (*MD 5011*, cystocarpic) and on rocks of the old jetty in Coos Bay in June (*MD 4542*).

PETROGLOSSUM Hollenberg, 1939

Petroglossum pacificum Hollenberg, 1943:573. *figs. 1–6.*

Thallus 100–120 μ thick, 3–5 mm. broad, and up to 3 cm. tall, bright red; arising from a thin discoidal holdfast by means of a short cylindrical stipe (up to 1.5 mm. long and 0.3 mm. broad) that bears distichous opposite bladelets in a few pairs, these in turn stipitate; blade irregularly dichotomous or simple, margin smooth but sinuous; tip rounded; cortex of one or two layers of small cells a little lower than tall in cross section and averaging about 10 μ in the greatest diameter, sub-cortex of one or two larger cells; medulla of large cells hexagonal in surface view and irregularly elliptical in cross or longitudinal section and about 70–80 μ in diameter; no veins or ribs.

MD 4996, North Bay in July, and *MD 2599*, Brookings in June, both sterile and the latter on the vertical sides of HHLW rocks and on small barnacles (*Balanus sp.*) overhung by larger algae.

This material differs from Hollenberg's description in being broader, in having opposite pinnules arising from the cylindrical stipe, and in the slightly larger size of the outer cortical cells.

STENOGRAMME Harvey, 1841

Stenogramme californica Harvey, 1841:408; — Smith, 1944:276. *pl. 64, fig. 4*; *pl. 65, fig. 4.*

Throughout the range at MLLW level and lower.

GIGARTINACEAE

GIGARTINA Stackhouse, 1809

Gigartina mamillosa (Goodenough & Woodward) J. Agardh, 1851:278; — Setchell & Gardner, 1933:285.

Reported in Oregon from Seal Rocks by Setchell & Gardner (*A. R. Sweetser 35*, June). F. P. Sipe recently collected material at this same locality that looks very much like the Sweetser collection. This entity seems to occur elsewhere along the Oregon coast and south into California. Whether it is specifically distinct from *G. papillata* and *G. cristata* is debatable. This species along with *G. papillata* dominates an irregular zone between the HHLW and LLHW tide levels; immediately beneath the zone dominated by *Gloiopeltis furcata.*

Gigartina papillata (C. Agardh) J. Agardh, 1846: *pl. 19*; — Smith, 1944:283. *pl. 70, fig. 2.*

Gigartina papillata var. *subsimplex* Setchell, 1898, *in* Collins *et al.*, Phyc. Bor.-Amer. fasc. 9:425.

Gigartina obovata J. Agardh, 1899:25; — Setchell & Gardner, 1933:268. *pl. 62.*

Throughout the range in scattered tufts between HHLW and LHHW tide levels. Some of the broader forms of this species are among the highest-growing of all species of *Gigartina.* The broad **G. papillata** var. **obovata** (J. Agardh) com. nov. (syn. *G. obovata* J. Agardh. Anal. Alg., 1899:25) is in places the dominant algal cover lower than typical for the species in the Brookings region (*e.g., MD 6124*) where it is best developed in the lower part of the *Fucus*-zone of distribution.

Gigartina cristata (Setchell) Setchell & Gardner, 1933:290. *pl. 64*; — Smith, 1944: 284. *pl. 69, fig. 2.*

This species is common at Brookings, Cape Blanco, Cape Arago, and on the old jetty within Coos Bay (*e.g., MD 2708*). Because of its habit of growth on the tops of boulders (2–3 feet in diameter) it is difficult to estimate its position in the vertical scale but it seems rather restricted about mean sea level, or in the uppermost part of the LHLW to HHLW zone.

Gigartina volans (C. Agardh) J. Agardh, 1846. *pl. 18*; — Smith, 1944:282. *pl. 70, fig. 1.*

The Gardner collection number *6536* mentioned by Setchell & Gardner (1933:280) represents a form that is abundant in the sand about the rocks at the mouth of the Carmel River, Monterey County, California.

It seems to arise as the result of sanding-in around the bases of thalli that are typical in appearance when the process begins but which elongate and expand as the thallus is gradually buried. Such forms have been collected in Oregon. They are common at a number of localities along the central coast of Oregon. This species has also been found at Cannon Beach (about the south inshore side of the high rocks there), Clatsop County, and Seal Rocks (*O'Neal 430*), Lincoln County, in the northern part of the state.

Gigartina Harveyana (Kützing) Setchell & Gardner, 1933:276; — Smith, 1944:282. *pl. 67, fig. 2.*

In color, texture and form the Oregon specimens are in every way like those collected on the Monterey Peninsula. They (*MD 4523*) were growing in the sand on a tidepool bottom near the old jetty in Coos Bay, in June.

Gigartina californica J. Agardh, 1899:39; — Smith, 1944:280. *pl. 67, fig. 1.*

Sparse in the Cape Arago and Coos Bay regions but becoming common further south at Brookings; growing on rocks between MLLW and LLLW and lower.

Gigartina exasperata Harvey & Bailey, 1851:371; — Setchell & Gardner, 1933:275.

Throughout the range below MLLW levels.

This species differs from *G. Binghamiae* in being thicker and in having the surface covered with acuminate papillae of different sizes when young. The papillae are often bifurcate or bear more than one cystocarp, and the cystocarps are not nearly as sessile as in *G. Binghamiae.* The color is dark reddish to light brownish red.

Gigartina Binghamiae J. Agardh, 1899:33; — Setchell & Gardner, 1933:277. *pl. 55.*

Common in the Coos Bay region below the MLLW level. Also brought up once in an otter trawl from 25 fathoms, 8 miles off the Coos Bay Bar in November (*H. C. Luce 9*, collected by Clarence Hubbard, cystocarpic).

This species is to be distinguished from other species in the section *Cheilogigartina* by its light red color (which is not at all brownish or orange, as in *G. corymbifera* or *G. Harveyana*), by its thin fronds, and by the way the large solitary cystocarps terminate rather long papillae along the frond margins and their relatively sessile sparse arrangement on the surface of the blades.

Gigartina canaliculata Harvey, 1841:490; — Smith, 1944:278. *pl. 69, fig. 3.*

Common on LHLW to MLLW rocks near the lighthouse reef on Cape Arago (*MD 2187*, June); at North Bay (*MD 2681*, July); and at South Bay (*MD 6338*, January); growing intermingled with *Odonthalia floccosa* and *Gelidium Coulteri.*

RHODOGLOSSUM J. Agardh, 1876

Rhodoglossum affine (Harvey) Kylin, 1928:49; — Smith, 1944:287. *pl. 71, fig. 2.*

Found at Cape Blanco (*O'Neal 419*); outer reef at Squaw Island (*MD*

2394, collected by O. R. O'Neal, and *MD 2302*); and Coos Bay (*Wayne Wells 37*). In the LHLW to MLLW zone.

While most of the material is depauperate and juvenile the collection from Squaw Island by O'Neal is cystocarpic. This is the northern limit for the species as known at present.

IRIDOPHYCUS Setchell & Gardner, 1936

Iridophycus flaccidum Setchell & Gardner, 1937:171; — Smith, 1944:288. *pl. 72, fig. 2.*

Probably throughout the range, but definitely known only from Cape Arago southward. This is one of the dominant species of the HHLW to LHLW zone. Fertile and abundant throughout the summer and fall months, but scarce in winter, though a few mature specimens may be found then.

Iridophycus splendens Setchell & Gardner, 1937:170; — Smith, 1944:289. *pl. 72, fig. 1.*

Throughout the range between LHLW and MLLW levels. This alga is one of the dominant and characteristic species of this zone.

Iridophycus lineare Setchell & Gardner, 1937:171; — Smith, 1944: 290. *pl. 72, fig. 3.*

Throughout the range south of Cape Mears (*MD 2725*); most abundant at Otter Point (*MD 6228*).

When exposed by recession of the tide the blades of this alga, when growing in characteristic thick clumps, tend to form piles of blades which stand close together like the leaves of a book. In such clumps the fruiting may be conspicuously marginal. In clumps which are not so dense the characteristic ruffling of the margins of the blades is less apparent or may be absent entirely.

Iridophycus oregonum sp. nov.

PLATE 11, FIG. C

Thallus 2 ad 7 cm. latitudine et usque ad 25 cm. altitudine, plures proliferationes laterales praebens aut saltem partem superiorem irregulariter furcatam habens; stipes levis; apophysis plana, levis, late cuneata, venis praedita; medulla e filamentis tenuibus magna ex parte circa 5 micra diametro constans; cortex circa 80 micra crassitudine, tetrasporangiales minus quam 0.5 mm. diametro; tetrasporangia 25 ad 40 per 55 ad 70 micra, cruciata.

Thallus 2–7 cm. broad and up to 25 cm. tall; dark purplish when dry, less than 1 mm. thick; with several lateral proliferations or at least with the upper portion irregularly furcate; stipe smooth, terete, 0.75 mm. in diameter and up to 2 mm. long; apophysis plane, with a smooth margin, broadly cuneate or rounded, with no veins; medulla composed of slender filaments usually about 5 μ in diameter and never over 9 μ, except for the occasional stellate cells and larger cells that give rise to the tetrasporangial sori; cortex about 80 μ in thickness, of about 5 or 6 globose cells less than 10 μ in diameter and lying in widely separated vertical columns, the outer three cortical cells usually elongated perpendicular to the blade surface,

the innermost often elongated parallel to the thallus surface by processes that may appear as an equatorial swelling; tetrasporangial sori less than 0.5 mm. in diameter, the first formed within the apex of the blade, later-formed sori towards the base, the last-formed produced in the upper portion of the apophysis; tetrasporangia arising to either side of the axial filaments from large irregularly shaped cells up to 25 μ in diameter, tetrasporangia 25–40 x 55–70 μ and cruciate for the most part but often dividing quite irregularly.

TYPE: *MD 4056* (Dudley Herbarium *306918*), collected at Brookings, Oregon, on boulders in a tidepool between HHLW and LLHW, December 16, 1941. Only tetrasporic material was obtained.

At first glance this material seems identifiable with *Iridophycus sinicola* Setchell & Gardner. It differs from the type of that species at the University of California and from isotypes in the Dudley Herbarium, in having a greater number of narrower divisions, and in the less conspicuous more quickly broadened apophysis, as well as in the general aspect of the frond. From *I. heterocarpum* this species differs in having a much thinner cortex, in having longer, larger, and less-branched medullary cells, in the thinner frond, in the branching, and in the larger tetrasporangia.

Iridophycus heterocarpum (Postels & Ruprecht) Setchell & Gardner, 1937:170; — Smith, 1944:291. *pl. 73, fig. 3.*

Throughout the range.

Iridophycus coriaceum Setchell & Gardner, 1937:170; — Smith, 1944:290. *pl. 71, fig. 4.*

Throughout the range in exposed situations between MLLW and LLLW levels or lower. Specimens collected below the MLLW level are typical; specimens occasionally collected at higher levels are atypical, and may be found as high as HHLW levels in much exposed situations.

Iridophycus parvulum (Kjellman) Setchell & Gardner, 1937:170; — Collins *et al.*, 1902, Phyc. Bor.-Amer. fasc. 19:930.

On the sunny sides of huge boulders along with *Endocladia* in the LLHW to HHLW zone at Harris State Park (*MD 6155*), cystocarpic and tetrasporic in July.

Distinguished from other Oregon species of this genus by the brownish color, by the thick and leathery texture when fresh, by the small size (under 8 cm. broad by 10 cm. tall), by the suddenly broadened (to as broad as cordate) base, by the furcate or proliferous upper margin, and by the close often confluent tetrasporangial sori. This species differs from *I. heterocarpum* in the smaller cystocarps (in dried material almost entirely under 1.5 mm. in diameter) that are of more uniform size, with the oldest nearest the upper margin of the frond. The short stipe that is immediately cuneate, broadening into the thickened and often radiately veined but indefinitely limited apophysis, serves as an aid in distinguishing this entity from small forms of *I. coriaceum*.

Iridophycus fulgens Setchell & Gardner, 1937:173.

There are several collections in western herbaria from the Cape Arago region, but their position in reference to tide level is not known.

Iridophycus Whidbeyanum Setchell & Gardner, 1937:172.

There are two specimens (*O'Neal 421, 413*) collected from beach wash at Cape Blanco in June. Although these specimens have the thickness of *I. coriaceum* they have the form and structure described for *I. Whidbeyanum*.

Iridophycus cordatum (Turner) Setchell & Gardner, 1937:170.

Collected once (*O'Neal 415*) washed ashore at Cape Blanco in June.

Iridophycus sanguineum Setchell & Gardner, 1937:172; — Smith, 1944:289.

Known in Oregon from Lighthouse Beach by one collection in the University of California herbarium and from several of O'Neal's collections at Cape Blanco (*e.g., 366*).

ERYTHROPHYLLUM J. Agardh, 1871

Erythrophyllum Delesserioides J. Agardh, 1872:10; — Smith, 1944:292. *pl. 73, fig. 4.*

Throughout the range on shady rocks between the MLLW and LLLW levels.

Erythrophyllum splendens sp. nov.

PLATE 14, FIG. A

Thallus e laminis pinnatis ex axe rhizomaticoideo orientibus compositus, axe hapteron discoideum, fortasse vestigium thalli iuvenilis, habente; thallus nitido-ruber, lineari-lanceolatus, in basi rotundatus, in margine denticulatus, in omnibus praeter lamellas maximae iuveniles costas subnigras prominentes atque fere percurrentes habens, venulae laterales nullae.

Thallus up to 30 cm. tall; of pinnate blades 1–3 cm. broad, arising from a rhizome-like axis that itself has a discoidal holdfast, perhaps the remnant of the juvenile thallus; clear bright red (about Deep Rose Pink and darker to about Bordeaux through the Eugenia Red series of Ridgway when pressed and dried quickly on herbarium sheets), with a prominent and nearly percurrent blackish midrib in all but the youngest bladelets, with no veins from the midrib; bladelets linear lanceolate, rounded at the base, denticulate on the margin.

TYPE: *C. L. Doty 1951* (Dudley Herbarium *306922*), washed ashore at Sunset Bay, Cape Arago, Coos County, Oregon, July 11, 1940. **COTYPE:** *MD 2758* (Dudley Herbarium *206921*), found cast ashore in August at Sunset Bay.

Juvenile thalli are not markedly different from those of *E. Delesserioides*. Mature thalli of *E. splendens* differ in the shape of blades, lack of lateral veins from the midribs, and in the color, as well as by the pinnate nature of the mature frond. In cross section the cortex is thinner and of lower cells fewer in number than in *E. Delesserioides* and the medulla is

less dense; though the whole frond may be just as thick as the frond of *E. Delesserioides* of the same size.

RHODYMENIALES

RHODYMENIACEAE

RHODYMENIA Greville, 1830

Rhodymenia palmata var. **mollis** Setchell & Gardner, 1903:315; — Smith, 1944:301.

Most frequently found in tidepools partially filled with sand and between the MLLW and LLLW levels; Rogue River Reef, Cape Blanco, Cape Arago, and Boiler Bay. Tetrasporic material was collected in December (*MD 2550*) at Lighthouse Beach.

Rhodymenia pertusa (Postels & Ruprecht) J. Agardh, 1851:376.

There are two stations, one at Squaw Island (*MD 2289, 2651, O'Neal 485*) and the other along the north shore of Sunset Bay (*MD 4582*), where this species is always to be found in narrow or shaded crevices in the MLLW to LLLW zone.

Rhodymenia pacifica Kylin, 1931:21. *pl. 9, fig. 21*; — Smith, 1944:301. *pl. 76, fig. 1.*

Common at most stations from Cape Arago southward, growing between MLLW and LLLW tide levels.

Rhodymenia californica Kylin, 1931:21. *pl. 9, fig. 22*; — Smith, 1944:300. *pl. 74, fig. 2.*

Throughout the range south from Cape Arago, at about the same levels as *R. pacifica.*

FAUCHEA Montagne, 1846

Fauchea laciniata J. Agardh, 1884:40; — Kylin, 1931:9. *pl. 2, fig. 3* (figure of type specimen).
Fauchea media Kylin, 1941:27. *pl. 10, fig. 24*; — Smith, 1944:295. *pl. 73, fig. 1.*
non Fauchea laciniata Setchell & Gardner, 1903:313 (which is *fide* Kylin, 1925:39, *F. Fryeana*).
non Fauchea laciniata Setchell, 1901:124 (which is some species of *Callophyllis, fide* Smith, 1944:296).

Washed in and on LLLW rocks at North Bay in late July, both cystocarpic and tetrasporic.

Study of all herbarium material available of this genus shows that there are neither qualitative nor any non-intergrading quantitative differences between the specimens of *Fauchea* with the cystocarps spread over the surfaces of the frond. For this reason *F. media* is placed as a synonym of *F. laciniata.* The type of *F. laciniata,* as figured by Kylin, is perhaps an extremely laciniate form but no more than that. *F. Fryeana,* the northwest Pacific species with marginal cystocarps, seems to have a similar gamut of marginal variations. In none of the collections of *Fauchea* seen have there been detected any of the water-markings often so prominent in *Fryeella Gardneri.* While the tetrasporangial thalli remain reddish throughout, the

cystocarpic thalli when mature become thickened (1 mm.) and cartilaginous. As they further mature or begin to disintegrate they become still thicker, soft, translucent, and with a blue cast below. The surface becomes more or less papillose or roughened.

FRYEELLA Kylin, 1931

Fryeella Gardneri (Setchell) Kylin, 1931:16.
Fauchea Gardneri Setchell, 1901:125; — Setchell & Gardner, 1903:313. *pl. 19, fig. 30.*
Rhodymenia Gardneri (Setchell) Kylin, 1925:41. *figs. 22a–b.*

PLATE 12, FIG. A

Specimens washed ashore at Lighthouse Beach in late July (*MD 5018*, both tetrasporic and cystocarpic) look very much like the type in the University of California herbarium. Another tetrasporic collection was made in July by *O'Neal*, number *442*, at North Bay.

This species is readily distinguished in the field from the species of *Fauchea* and *Callophyllis* by growth lines resembling watermarks across each of the upper segments of the fronds. As in *Fauchea* the thalli become thick at maturity but are without the blue cast.

HALOSACCION Kützing, 1843

Halosaccion glandiforme (Gmelin) Ruprecht, 1851:279. *pl. 16*; — Smith, 1944:298. *pl. 73, figs. 6–7.*

Throughout the range on rocks between the LHLW and MLLW levels; growing intermingled with *Rhodomela larix* and *Gigartina canaliculata*. This appears to be a summer annual and it is very unusual to find it in winter months in a mature condition, though a few very ragged large specimens can be found then.

CERAMIALES

CERAMIACEAE

CERAMIUM Roth, 1797

KEY TO THE SPECIES OF *CERAMIUM* OCCURRING IN OREGON

1. Cortication complete everywhere except for a line on the internodes; tetraspores not protruding at maturity except during liberation 4
1. Cortication incomplete; tetraspores emergent, if not protruding, even before maturity 2
2. Saxicolous; violet; tetraspores immersed .....**C. washingtoniense**
2. Epiphytic or saxicolous; reddish; tetraspores protruding 3
3. Saxicolous (or on wood); uncorticated areas proportionally longer below ..... **C. Gardneri**
3. Epiphytic; uncorticated areas proportionally shorter below, until basal branches often almost completely corticated .....**C. californicum**
4. Epiphytic; transverse bands inconspicuous except at the apex ..... **C. codicola**
4. Saxicolous; transverse bands conspicuous 5

5. Blackish; without short proliferous branchlets below; corticating cells in longitudinal rows; with gland cells at the nodes .....**C. Eatonianum**

5. Red or violet; with short proliferous branchlets below; corticating cells irregularly arranged; without gland cells at the nodes .....**C. pacificum**

Ceramium Eatonianum (Farlow) De Toni, 1903:1493; — Smith, 1944:327. *pl. 84, figs. 3–4.*
Ceramium zebrinum J. Agardh, 1894:37.
Centroceras oregonense J. Agardh, 1876:107.

Common throughout the range south of Coos Bay; saxicolous, usually between HHLW and LHLW, but occasionally lower. The type, collected by Elihu Hall in Oregon in 1871, was probably from the northernmost part of the coast, *i.e.*, Clatsop County.

Ceramium codicola J. Agardh, 1894:23; — Smith, 1944:326. *pl. 84, fig. 1.*

Throughout the range on its host *Codium fragile*. Tetrasporic material (*MD 2317*) has been found in July.

The tips in this species are often straight and long, *i.e.*, not cheliform. Usually at each fertile node the tetraspores appear in two transverse irregular rows; the sporangia alternating above and below the node, with this bi-lineal arrangement becoming less distinct as the tetraspores mature. The tetrasporangial initials are immersed when first recognizable; as they enlarge they spread the cortical cells that cover them and become exposed, but they do not project beyond the cortical cells except during the process of liberation.

Ceramium pacificum (Collins) Kylin, 1925:61; — Smith, 1944:326. *pl. 83, fig. 3.*

Present in abundance throughout the range lining the edges of shallow tidepools between HHLW and LHLW levels.

Ceramium washingtoniense Kylin, 1925:62. *fig. 41.*

Known from a collection made in August by F. P. Sipe between Sea Lion Point and Cape Perpetua. The alga grew between the LHLW and MLLW tide levels and in association with *Plocamium pacificum* and *Corallina densa*. The *C. washingtoniense* reported from the Cape Arago region by Sanborn and Doty (*ined.*) is a form of *C. pacificum*.

Ceramium californicum J. Agardh, 1894:45.

Thallus up to 6 cm. high, light red; primary branching alternate with many adventitious branches in the lower portion of the thallus; many of the adventitious branchlets opposite each other or opposite a larger branch; cortical bands in the upper part of the thallus prominent and leaving about one-fourth of the internode uncorticated; this proportion of uncorticated area decreases about 6–9 dichotomies below the tips and near the base of the thallus the major axes are almost or entirely corticated; procarps appearing along the upper abaxial (usually) surfaces; the cystocarp naked except for a short involucral branchlet developing just below it; tetrasporangia protruding from the upper edge of the cortical bands, developing as in *C. Gardneri*.

Epiphytic on *Gracilaria Sjöstedtii* in lower Coos Bay and about Cape Arago in July (*MD 4631*, cystocarpic; *MD 6315*, tetrasporic; *O'Neal 449*; *MD 5026*, ?male).

Ceramium Gardneri Kylin, 1941:29; — Smith, 1944:325. *pl. 84, fig. 2.*

On lightly wave-swept rocks (*MD 4200*, South Bay, cystocarpic in January); and on the wharf at Charleston (*C. L. Doty, 1929*, July). This latter collection looks very much like material collected at the type locality. It seems that, since this species forms low mats of interlaced erect thalli just below and with *Lessoniopsis*, its place in the vertical scale must be in the lower part of the MLLW and LLLW zone.

In addition to its growing in a distinctive habitat this species differs from the next above in that the uncorticated internodes become progressively longer from the apex to the base of the thallus and throughout most of the thallus occupy about four-fifths or less of the axial surface. The main axis is conspicuously dichotomous and bears very few simple lateral branchlets The tetrasporangia protrude at maturity from the lateral and upper surfaces of the nodal cortication. On upper dichotomies they are developed in a ring about the node, with those on the adaxial side developing first; on the lowest dichotomies the tetrasporangia appear first on the adaxial side and may or may not appear later on the other surfaces of the dichotomies.

MICROCLADIA Greville, 1830

Microcladia Coulteri Harvey, 1853:209. *pl. 33, fig. A*; — Smith, 1944:329. *pl. 86, figs. 1–2.*

Known only from two collections in the Brookings area in July (*MD 6108* on *Iridophycus* and *MD 6190* on *Gigartina californica*).

Microcladia borealis Ruprecht, 1851:259; — Smith, 1944:330. *pl. 85, fig. 11.*

Throughout the range in shaded places exposed to the surf and therefore the vertical range is indefinite but where this alga appears with *Lessoniopsis* and *Postelsia* it is above or just in the top of the *Lessoniopsis* zone. At Mussel Point, Pacific Grove, California, it usually grows in the LHLW to MLLW zone.

Farlow (1875:372) gives the only record of *Microcladia californica* growing in Oregon.

PLUMARIA Stackhouse, 1809

Plumaria filicina (Farlow) comb. nov.

Ptilota plumosa var. *filicina* Farlow, 1875:374.

Ptilota filicina (Farlow) J. Agardh, 1876:76; — Smith, 1944:333. *pl. 85, figs. 5–6.*

Throughout the range as an epiphyte. Cystocarpic, antheridial, and tetrasporic during the summer months.

Plumaria tenuis (Kylin) comb. nov.

Ptilota tenuis Kylin, 1925:60. *fig. 40*; — Collins *et al.*, 1903, Phyc. Bor.-Amer. fasc. 23:1148.

Saxicolous; South Bay (*MD 4103*) and Brookings (*MD 4178*) in December, tetrasporic.

This species differs from *P. filicina* in being much more delicate throughout and in having many of the opposite branchlets similarly developed. The most conspicuous difference is that the tetrasporangia are not produced in a head-like cluster of slender branchlets but arise from the serrations along the upper surface of the branchlets.

Plumaria hypnoides (Harvey) comb. nov.
Ptilota hypnoides Harvey, 1833a:164; — Smith, 1944:332. *pl. 85, figs. 3–4.*

Throughout the range, usually on *Calliarthron* spp.

Plumaria californica (Ruprecht *ex* Harvey) comb. nov.
Ptilota californica Ruprecht *ex* Harvey, 1853:222; — Smith, 1944:332. *pl. 85, figs. 1–2.*

From Oregon there are collections from Lighthouse Beach, North Bay and South Bay.

This species differs from *Pl. asplenioides* [1] in having longer, narrower simple branchlets, serrulate only on the abaxial surface, and these not decurrent below. From *Pl. densa* [2] it differs in having almost smooth branchlets that are more slender, though sometimes their crowded appearance gives the impression that one has collected a form of *Pl. densa.*

ANTITHAMNION Nägeli, 1847

Antithamnion defectum Kylin, 1925:46. *fig. 27*; — Smith, 1944:308. *pl. 87, figs. 1–2.*

Only known from the Cape Arago region (*MD 4198*; *MD 4201*) where it is usually epiphytic or on hydroids.

Antithamnion glanduliferum Kylin, 1925:47. *figs. 28e–g*; — Smith, 1944:310. *pl. 77, fig. 4.*

Only collected once (*MD 2234*) on *Fucus evanescens* in the mouth of Haynes Slough, Coos Bay.

This species is very much like *A. pacificum* and differs from that species in that it has gland cells and the tetrasporangia are sessile. From *A. occidentale* it differs both in the complete lack of verticils and in having more delicate, only slightly tapered branchlets, the cells of which are quite rounded in the corners so as to seem rather widely separated. In both of these species the diameter of the terminal cell of a branchlet is usually about half that of the basal cell and the apices are blunt. *Antithamnion glanduliferum*, while it may be relatively short and bushy in habit, tends

[1] **Plumaria asplenioides** (Turner) comb. nov.
Fucus asplenioides Turner, 1808: *pl. 62.*
Ptilota asplenioides (Turner) C. Agardh, 1822:387.

Farlow (1875:375) says that, "this occurs in Oregon, and is a common species of Alaska." If this is correct it is the only record and only mention of this species south of Canada with the exception of one old record (Harvey and Bailey, 1851) from Puget Sound. The material distributed in the Phyc. Bor.-Amer. is similar in size of frond and branch breadth to *Pl. hypnoides*, but the bases of the ultimate branchlets are strongly decurrent toward the base of their parent axis. De Toni (1903:1378) considered *Pt. asplenioides* to be related to *Pt. californica* Ruprecht.

[2] **Plumaria densa** (C. Agardh) comb. nov.
Ptilota densa C. Agardh, 1822:387; — Smith, 1944:333. *pl. 85, figs. 7–8.*

to become long and lax like *A. pacificum*; *A. occidentale* usually develops a stronger bushier thallus than either.

Antithamnion Kylinii Gardner, 1927d:411. *pl. 89, fig. 1*; — Smith, 1944:307. *pl. 77, fig. 1*; *pl. 78, fig. 5.*

Dredged on dead shells in South Slough above Charleston, July (*MD 4718a*). The specimens compare very well with an isotype in the Dudley Herbarium.

Among the Pacific Coast pectinate species, *A. Kylinii* is characterized by having a branchlet opposite each major branch, and further distinguished by having only a few patent gradually-tapered acutely-tipped branchlets on a major branchlet. These outwardly directed but widely spreading ultimate branchlets are like the tip of the parent branchlet and arise from its outer part. The basal 3 to 6 cells of the parent branchlet bear as a rule only dwarfed branchlets, if any.

Antithamnion occidentale Kylin, 1925:47. *fig. 30a–d*; — Smith, 1944:312.

A common alga on the wharf timbers at Charleston and in the Siuslaw Bay with cystocarps in July.

Carpospores irregularly rounded polygonal and up to 48 μ in their longest dimension. Tetrasporangia up to 47 x 65 μ. See *A. glanduliferum* for a comparison with that species.

Antithamnion pacificum (Harvey) Kylin, 1925:47. *fig. 28c–d, fig. 29*; — Smith, 1944:310.

On large kelps known definitely only from the Cape Arago region.

Antithamnion pygmaeum Gardner, 1927d:413. *pl. 91–93*; — Smith, 1944:309. *pl. 78, fig. 4*; *pl. 80, fig. 1.*

Washed in on *Plumaria hypnoides* at Lighthouse Beach (*MD 5029*), and scraped from the surface of crustaceous corallines (*MD 5278*) at Middle Bay. Both collections made in July.

Antithamnion subulatum (Harvey) J. Agardh, 1892:20; — Kylin, 1925:50. *fig. 31*; — Smith, 1944:312. *pl. 78, fig. 3.*

Male thalli (*MD 4217*) Sunset Bay, June; dredged on shells in South Slough above Charleston (*MD 4718b*), tetrasporic, July.

Branchlets mostly in pairs except at origins of major branches where there is usually a verticil of three. Branchlets mostly not over 20 μ at their bases. Tetrasporangia broadly elliptical, up to 52 x 82 μ.

Antithamnion tenuissimum Gardner, 1927c:377. *pl. 77.*

The branching, cells, and general proportions are quite like Gardner's description and figure; however no gland cells were found and the largest tetrasporangia were about 50 x 70 μ (*MD 2359* and *J. C. Queen 106*, floating timber at Marshfield on Coos Bay, July). The tetrasporangia are elliptical at first; pyriform and finally almost spherical at maturity.

Antithamnion uncinatum Gardner, 1927d:408. *pl. 89, fig. 2*; *pl. 90*; — Smith, 1944: 312. *pl. 76, fig. 4.*

Throughout the range as an epiphyte chiefly on *Nereocystis*. Male and

tetrasporic individuals were collected from this host in July south of the Chetco River (*MD 6089*); material with abundantly developed tetrasporangial fascicles in June at Cape Blanco (*O'Neal 423*); young female material washed in near the south jetty of Coos Bay (*MD 2499*, collected by *Mrs. Mildred Detling*) in July; among many others.

Antithamnion Baylesiae Gardner, 1927c:375. *pl. 75, fig. 1*; — Smith, 1944:313.

Dredged on shells in the channel of South Slough above Charleston (*MD 4721*, July).

PLATYTHAMNION J. Agardh, 1892

Platythamnion heteromorphum J. G. Agardh, 1892:23; — Smith, 1944:315. *pl. 79, fig. 3.*

Sunset Bay (*MD 2677*) tetrasporic in July.

Platythamnion villosum Kylin, 1925:51. *figs. 32a–b, 33a–d*; — Smith, 1944:315. *pl. 79, fig. 2.*

Tetrasporic (*MD 6308*) at Middle Bay in July and antheridial and cystocarpic (*MD 4217*) at Sunset Bay in June.

Platythamnion pectinatum Kylin, 1925:53. *figs. 32d, 33e, 34a–c*; — Smith, 1944: 316. *pl. 79, fig. 1.*

Throughout the range mostly on floating timbers. Tetrasporic and cystocarpic thalli found throughout the summer.

CALLITHAMNION Lyngbye, 1819

Callithamnion Pikeanum Harvey, 1853:230; — Smith, 1944:318. *pl. 18, fig. 2.*

Throughout the range on vertical surfaces between HHLW and LHLW levels. Tetrasporic material collected at Cape Blanco in early summer (*C. L. Doty 2514*). Male thalli were collected (*MD 6340*) on *Odonthalia floccosa* at South Bay in January. The spermatia are produced at the apices of sets of bushy branches originating singly or in pairs from the upper ends of cells on the upper branches of the thallus.

Callithamnion Pikeanum var. **pacificum** (Harvey) Setchell & Gardner, *in* Gardner, 1927d:406. *pl. 87, figs. 2–3.*

Tetrasporic material collected in late June at Cape Blanco (*O'Neal 422b*). Throughout the range at the same levels as the species.

Callithamnion Pikeanum var. **laxum** (Setchell & Gardner) comb. nov.

Ceratothamnion Pikeanum var. *laxum* Setchell & Gardner, 1903:339. Originally forma *laxum*.

Callithamnion laxum (Setchell & Gardner) Setchell & Gardner, *in* Gardner, 1927d: 407. *pl. 88.*

This variety has been collected at Otter Point (*MD 6223*) in early July, and in addition tetrasporangial, antheridial, and cystocarpic material at Brookings in late June (*O'Neal 284b*). Previously reported only from the Puget Sound region.

Various stages in the development show that the procarp forms from the

basal cell of a 6- or 7-celled apical branch, with two primary cystocarps developing first in a bilateral position with regard to the parent branch.

GRIFFITHSIA C. Agardh, 1817

Griffithsia pacifica Kylin, 1925:58. *figs. 39–40*; — Smith, 1944:324. *pl. 83, fig. 2.*

In tufts below MLLW at Sunset Bay (*O'Neal 429*, June) and at North Bay (*MD 4979*, July).

DELESSERIACEAE

DELESSERIA Lamouroux, 1813

Delesseria decipiens J. Agardh, 1872:58; — Smith, 1944:338. *pl. 87, figs. 3–4.*

Throughout the range between the MLLW to LLLW levels on more or less shaded rocks. Tetrasporic and cystocarpic in the summer months.

MEMBRANOPTERA Stackhouse, 1809

Membranoptera platyphylla (Setchell & Gardner) Kylin, 1924:15. *figs. 7–8.*

Fronds up to 1.5 cm. broad and up to 8 cm. tall, with much divided tips; midrib conspicuous below and sometimes over 1 mm. broad; lateral veinlets inconspicuous and rebranched abaxially; margin minutely serrulate, but sometimes sinuate to nearly smooth; cystocarps toward the apex of the ultimate branchlets, often solitary, but at times in a linear series of 2 or 3, hemispherical, the ostioles projecting forward, ostioles usually cylindrical but at times funnel-like; tetraspores in rows lateral to the midrib, in the lower parts of the blade extending out along the lateral veinlets.

On piling of the old wharf in lower Coos Bay (*MD 4616*, tetrasporic in July). The Oregon material is quite similar to specimens in the University of California herbarium identified as *M. platyphylla* by Gardner.

Membranoptera multiramosa Gardner, 1926:209. *pl. 19, fig. 1*; — Smith, 1944:337. *pl. 86, figs. 3–4.*

Pendant from rocks in shaded situations between MLLW and LLLW at South Bay (*MD 1994*) in July and at Middle Bay (*MD 4204*) in January. Both collections are tetrasporic.

Membranoptera dimorpha Gardner, 1926:211.

Throughout the range south to the Rogue River Reef (*MD 6171*) and to Brookings (*MD 2601* and *MD 6111*). Growing below the MLLW level.

ERYTHROGLOSSUM J. Agardh, 1898

Erythroglossum californicum J. Agardh, 1898:176; — Kylin, 1941:31. *pl. 10, fig. 28*; — Smith, 1944:339. *pl. 87, figs. 5–6.*

Two collections known from Oregon, one washed ashore near the south jetty of Coos Bay (*MD 2496*) and the other growing near LLLW on a vertical rock surface a foot below the bottom of a large tidepool at Middle Bay (*MD 5287*).

POLYNEURA Kylin, 1924

Polyneura latissima (Harvey) Kylin, 1924:37. *figs. 27–28*; — Smith, 1944:341. *pl. 87, fig. 8.*

Throughout the range below the MLLW level, both cystocarpic and tetrasporic thalli collected during the summer.

PHYCODRYS Kützing, 1843

Phycodrys Setchellii Skottsberg, 1922:433. *fig. 4*; — Smith, 1944:342. *pl. 87, fig. 2*; *pl. 88, fig. 7.*

One collection (*MD 4205*) in January near the LLLW level on rocks over a deep pool at Middle Bay, cystocarpic.

The Oregon thalli are narrower than those usually found along the coast of California. The venation and thickness of the blade is as in specimens seen from California.

NIENBURGIA Kylin, 1935

Nienburgia Andersoniana (J. Agardh) Kylin, 1935:1; — Smith, 1944:345. *pl. 90, figs. 1–2.*

The only specimens of *Nienburgia* collected in Oregon are juvenile (*MD 4634*, Middle Bay, and *MD 1856*, Sunset Bay); so that they cannot be identified with absolute certainty.

The material at hand is narrow and like *N. Andersoniana* rather than like *N. borealis* which seems to be a broader alga. *N. borealis* is recorded only from the Puget Sound region.

NITOPHYLLUM Greville, 1830

In Sanborn and Doty (*ined.*) *Nitophyllum mirabile* Kylin is credited to Oregon on the basis of a specimen collected by Hazel R. Hayden at Lighthouse Beach and identified by Setchell. After examining this specimen in the herbarium of the University of California (number *552381*) the author is of the opinion that it is *Hymenena Smithii* Kylin.

HYMENENA Greville, 1830

Hymenena multiloba (J. Agardh) Kylin, 1935:3; — Smith, 1944:350. *pl. 89, fig. 2.*
Nitophyllum multilobum J. Agardh, 1876:698.
Nitophyllum Fryeanum Harvey, 1858:128.
Hymenena Fryeanum (Harvey) Gardner, 1927a:244.

Washed ashore in July south of the mouth of the Chetco River (*MD 6101*, July) and collected in January between the LHLW and MLLW levels on rocks at South Bay (*MD 4104*). Both collections were tetrasporic. See under *H. Setchellii* Gardner for a discussion of the nomenclature.

Hymenena flabelligera (J. Agardh) Kylin, 1924:83. *fig. 68*; — Smith, 1944:348. *pl. 89, fig. 3.*

Throughout the range in somewhat exposed situations; between the MLLW and LLLW levels.

Hymenena Smithii Kylin, 1941:33. *pl. 11, fig. 31*; — Smith, 1944:351. *pl. 89, fig. 1.*

Tetrasporic material was found cast ashore at Sunset Bay in July (*MD 2411*). In the University of California herbarium (number *552381*) is a fragment of a cystocarpic thallus found floating at Lighthouse Beach in July by *Hazel R. Hayden* (*42*).

Hymenena Setchellii Gardner, 1927a:245. *pl. 28–31*; — Smith, 1944:350. *pl. 89, fig. 4.*

Nitophyllum Fryeanum Farlow, 1878, *in* Alg. Exc. Amer. Bor. no. 69; — Collins *el al.*, 1911, Phyc. Bor.-Amer. fasc. 35:1742; — Nott, 1900:22.

Hymenena Fryeana (Nott) Kylin, 1924:81; — Kylin, 1941:33.

non H. Fryeana Gardner, 1927a:244.

Frequent on sunken stumps in Sunset Bay at LLLW and lower levels. Occasionally washed ashore at other stations on Cape Arago. Cystocarpic, tetrasporic, and antheridial during late July and August.

In 1858 Harvey described *Nitophyllum Fryeanum* on the basis of poor material from San Francisco. Nott (1900:23) pointed out that this *N. Fryeanum* of Harvey's was probably the same as *N. multilobum* of J. Agardh, 1876. Kylin (1924:58) transferred this entity to *Myriogramme*, selecting the specific name of *multilobum* of J. Agardh rather than the earlier specific name *Fryeanum* of Harvey. In 1925, after better material had come into his hands, he verified the mutual synonymy of these last two specific names. Gardner (1927:244) found later that the *M. multiloba* (J. Agardh) Kylin belonged to the genus *Hymenena* as delimited by Kylin in 1924, and so he transferred this to *Hymenena* and called it *H. Fryeanum* (Harvey) Gardner. He was not justified in doing this for Kylin (1924:81) had already used the name *H. Fryeanum* when he made the combination *H. Fryeanum* (Farlow *in* Nott) Kylin. Therefore *H. Fryeana* (Harvey) Gardner must be discarded as a homonym and the next validly published name for this entity, *Hymenena multiloba* (J. Agardh) Kylin (1935:3), must be used.

In 1878 Farlow distributed, in the Alg. Exsic. Amer. Bor. No. 69, an alga he erroneously determined as *Nitophyllum Fryeanum* Harvey. Nott (1900:22) published a description of this as interpreted by Farlow but this name must be rejected as a homonym of *N. Fryeanum* Harvey as discussed above. Though Kylin (1924:81) made the combination *H. Fryeana* (Farlow) Kylin on the basis of Nott's (1900:22) description of the species and considered it valid because it was used in a different genus, this combination must be rejected because once the name for an entity is discarded as a homonym it cannot be used again; not only not within the same genus for another species, but neither can it be used for the same entity in any other genus. Since the name *Hymenena Fryeanum* is invalid, the next legitimate epithet for this entity, *H. Setchellii* Gardner (1927a:245), must be used.

There is no physical similarity between *H. Setchellii* Gardner and *H. multiloba* (J. Agardh) Kylin.

Hymenena Kylinii Gardner, 1927a:242. *pl. 32*; — Smith, 1944:349.

Throughout the range south of Cape Blanco (*MD 2530b*, cystocarpic in July) to Brookings (*MD 4175*, tetrasporic in December).

The above material compares well with Gardner's type in the University of California herbarium but in general has broader more divided apices.

Hymenena cuneifolia sp. nov.

PLATE 14, FIG. C

Laminae fertiles erectae e thallo prostrato in superficie inferiore per proliferationes rhizoideas affixo, usque ad 10 cm. altitudine, segmentis plerumque 1.5 cm. latitudine; costa ad basim ipsam partis indivisae frondis restricta, supra venulis subparallelis ad locum basium loborum ultimorum egressis; frons plana, supra expansa, marginibus autem ramorum rectis ut systemata ramificationis flabellata apellari non possint; tetrasporangia secundum venulas nata, in partibus frondium centralibus inferioribusque primum visa.

Fertile blades erect from a prostrate thallus anchored on the underside by rhizoidal proliferations, up to 10 cm. high with the segments mostly 1.5 cm. broad; midrib restricted to the very base of the undivided portion of the frond; above this more or less parallel veinlets extending to the bases of the ultimate lobes; frond plane, expanded above but branch margins straight so that the branch systems cannot be said to be flabellate; tetrasporangia borne along the veinlets, appearing in the central and lower portions of the fronds first.

TYPE: *MD 2134* (Dudley Herbarium *306920*), on the stones of the old jetty in Coos Bay at the mouth of South Slough, June 17, 1939. **COTYPE:** *C. L. Doty 1952* (Dudley Herbarium *306919*), washed in at Sunset Bay, June 11, 1940.

In addition to the type there is an apparently sterile specimen (*Charlotte L. Doty 1952*) that was washed in at Sunset Bay in early July.

This species differs from *H. flabelligera* in having a much broader, thinner thallus; in having an inconspicuous midrib visible for only a short distance (less than 2 cm.) above the base; and in having the branches of all orders more or less cuneiform with broadly rounded digitately divided apices. The tetrasporic material is distinctive in that the tetraspores mature early on the disc or in the central or basal parts of the blade. The blades are usually broadly rounded just above the short (2–4 mm.) stipe.

CRYPTOPLEURA Kützing, 1843

Cryptopleura brevis Gardner, 1927a:241. *pl. 25, fig. 2; pl. 26.*

Vertical range not well known but presumed to be HHLW to LLLW. The Oregon collections at hand are: *MD 4182*, Sunset Bay; *MD 6199*, Harris State Park; and *MD 6335*, washed onto the beach south of the Chetco River.

This species is only about half the size of *C. lobulifera* and grows in low stands somewhat like *Hymenena multiloba*. The branching is like that of *C. lobulifera* but the tetrasporangial sori tend to be produced on more or less lateral and terminal lobes instead of on merely enlarged ruffles as in that species.

Cryptopleura Ruprechtiana (J. Agardh) Kylin, 1924:93.

The exact identity of this entity can be questioned and the correct name for it may be *Hymenena* (*Cryptopleura*) *fimbriata* Postels & Ruprecht

(1840). However under the name *C. Ruprechtiana* there have been segregated the following specimens from Oregon: *MD 6103a*, washed onto the beach south of the Chetco River; *O'Neal 380*, Brookings; *O'Neal 385*, Brookings; *MD 6342* (collected by Miss Marjorie Maxwell), Mussel Reef, Cape Arago; *MD 1730*, Devil's Punch Bowl, Lincoln County.

Cryptopleura violacea (J. Agardh) Kylin, 1924:89; — Smith, 1944:352. *pl. 90, fig. 3.*

Rare in the southern part of the range.

The specimens referred to this species have the tetrasporangia in linear sori, and the cystocarps for the most part scattered along the margins of the thalli. The collections referred to *C. crispa* have the tetrasporangia and cystocarps chiefly in lateral proliferations of the margin. In addition, the branching of *C. violacea* is not at all flabellate and the upper parts of branches tend to be linear and narrower. In *C. crispa*, which likewise is not flabellate, the blades are more cuneate and not as linear as in *C. violacea*. Proliferous outgrowths are more frequent in *C. crispa* than in *C. violacea*.

Cryptopleura crispa Kylin, 1924:90.

Rare growing between MLLW and LLLW tide levels (*MD 2374*, Cape Arago, collected by John Queen; and *O'Neal 381*, ?Brookings).

BOTRYOGLOSSUM Kützing, 1843

Botryoglossum Farlowianum (J. Agardh) De Toni, 1900:676; — Smith, 1944:354. *pl. 91, figs. 1–2.*

Common throughout the range on rocks below the LLLW level and usually on *Cystoseira osmundacea*. One collection (*H. C. Luce 6a*, collected by Clarence Hubbard) was obtained from an otter trawl brought up 35 fathoms off a mud and sand bottom, 8 miles north of the Coos Bay bar.

RHODOMELACEAE

RHODOMELA C. Agardh, 1822

Rhodomela larix (Turner) C. Agardh, 1822:376; — Smith, 1944:374. *pl. 97, fig. 1.*

Throughout the range and one of the conspicuous indicators of the LHLW to MLLW zone.

ODONTHALIA Lyngbye, 1819

Odonthalia oregona sp. nov.

PLATE 13, FIG. B

Thallus usque ad 17 cm. altitudine; rami ubique teretes, alternati distichique, gradatim attenuati, minus quam 1 mm. diametro, supra circa 0.25 mm. diametro; niger cum exsiccatus et foliis herbari affixus; cystocarpi minus quam 0.5 mm. diametro, in racemis crebris, non autem confertis; tetrasporae in ramulis terminalibus dense factis, non autem valde ramosis natae.

Thallus up to 17 cm. tall; branches terete throughout, less than 1 mm. in diameter and the upper branches about 0.25 mm. in diameter; black in color when dried and mounted on a herbarium sheet; the branching alter-

nate and distichous; the branches gradually attenuated; cystocarps less than 0.5 mm. in diameter, in close but not dense racemes; tetraspores borne in densely produced but not strongly clustered terminal branchlets.

TYPE: *MD 6142d* (Dudley Herbarium *306917*), cast ashore about 1 mile south of the mouth of the Chetco River, Curry County, Oregon, July 3, 1944.

The slender, less densely tufted terete branches, and the minute cystocarps readily distinguish this species from others along this coast. The cystocarps of *O. floccosa* are over 0.5 mm. in diameter at maturity, and are usually about two or three times the diameter of those of *O. oregona*.

Odonthalia washingtoniensis Kylin, 1925:76.
Odonthalia semicostata Setchell & Gardner, 1903:336. *pl. 26–27*; — Collins *et al.*, 1902, Phyc. Bor.-Amer. fasc. 19:941.

Common on rocks between the MLLW and LLLW levels as far south as Cape Arago, and then rare as far south as Brookings (*O'Neal 402*, June).

Odonthalia floccosa (Esper) Falkenberg, 1901:607; — Smith, 1944:375. *pl. 97, fig. 2.*
Odonthalia aleutica Setchell & Gardner, 1903:333 (*non Rhodomela aleutica* C. Agardh); — Collins *et al.*, 1903, Phyc. Bor.-Amer. fasc. 23:1147.

Throughout the range and locally dominant between LHLW and MLLW.

Most of the Oregon collections can be referred to the variety *macrantha* (forma *macrantha* of Setchell & Gardner), though the variety *comosa* (forma *comosa* of Setchell & Gardner) is likewise to be found.

The statement that the cystocarps are borne in dense "head-like" glomerules is not correct for all forms. The very dense antheridial heads surrounded by rather long bract-like branchlets are illustrated by Setchell & Gardner (1903: pl. 27, fig. 50). The antheridial branches appear as colorless or brownish asymmetrical clubs in head-like clusters of short corymbose branchlets terminating the upper lateral branches. These are surrounded by the short vegetative bract-like branchlets mentioned above. Tetrasporic thalli are usually tufted in the same manner, but this is not true of the cystocarpic thalli collected along the Oregon coast. In many thalli the cystocarps are borne in racemose clusters along the upper branchlets and there are no short branchlets particularly associated with them.

POLYSIPHONIA Greville, 1824

Polysiphonia Collinsii Hollenberg, 1944:481. *figs. 2–5, 8*; — Smith, 1944:363.

Throughout the range, usually growing in low circular patches on vertical surf-swept rocks, mussels (*Mytilus* sp.), and coralline algae, between HHLW and LHLW levels. Cystocarpic and tetrasporic in December (*MD 5392*). No attempt was made to separate the varieties.

Polysiphonia paniculata Montagne, 1842:254; — Hollenberg, 1944:480. *fig. 7.*
Polysiphonia californica Smith, 1944:362. *pl. 93, fig. 1.*

Throughout the range between MLLW and LLLW and growing inter-

mingled with *Schizymenia pacifica* and *Porphyra occidentalis*. A collection from mussels, collected (*MD 5392c*) in December at Lighthouse Beach, has been identified by Hollenberg as a form of this species. As might be expected this material was young and sterile.

Polysiphonia Hendryi Gardner, 1927e:101. *pl. 24–25*; — Smith, 1944:363. *pl. 93, figs. 3–4*; — Hollenberg, 1944:482.

One collection from the flattened surface of the central axis of *Egregia* (*O'Neal 337* and *MD 2480*) at Sunset Bay, in July, has been determined as this species by Hollenberg.

Polysiphonia pacifica Hollenberg, 1942b:777. *figs. 2, 3, 12, 13*; — Smith, 1944:359. *pl. 94, fig. 3.*

Throughout the range but present in greatest abundance at Cape Arago between the LLHW and LHLW levels, on shaded vertical rocks.

Polysiphonia Snyderae Kylin, 1941:35. *pl. 12, fig. 34*; — Hollenberg, 1942b:781; — Collins *et al.*, 1899, Phyc. Bor.-Amer. fasc. 13:638.

One collection of freely and finely branched specimens was found floating in South Slough (*MD 2468*) in July. This material has the characteristic arrangement of scar cells and tetraspores but lacked the delicate and irregularly branched percurrent axis so conspicuous in the *Phycotheca* specimen and in Kylin's figure.

PTEROSIPHONIA Falkenberg, 1897

Pterosiphonia dendroidea (Mont.) Falkenberg, 1901:268; — Smith, 1944:366. *pl. 95, fig. 3.*

Throughout the range below the MLLW level. Generally growing on rocks but occasionally epiphytic. Isolated thalli have been found on the tops of flat rocks above the LLHW level where the rocks are continually dampened by spray.

Pterosiphonia bipinnata (Postels & Ruprecht) Falkenberg, 1901:273.

Throughout the range in tufts on vertical rocks below LHLW.

Pterosiphonia bipinnata var. **robusta** (Gardner) comb. nov.
Pterosiphonia robusta Gardner, 1927e:102.

P. robusta Gardner is not sufficiently distinct from *P. bipinnata* to merit recognition as a species, but it does differ sufficiently to be considered a variety. The major difference is in the strongly recurved simple branchlets that hold the major axes in symplocoid tufts. It also differs in that there are usually 14–15 pericentral cells. Tufts of this variety are taller and more apt to become very dark or blackish when dried on the herbarium sheet.

Cystocarpic, antheridial, and tetrasporic material was present in the collection (*MD 6130*) made along the north shore of Chetco Cove in July.

Pterosiphonia gracilis Kylin, 1925:72, *fig. 47a.*

One collection (*MD 2678*) from Sunset Bay in July. The thalli were tetrasporic.

PTEROCHONDRIA Hollenberg, 1942

Pterochondria Woodii (Harvey) Hollenberg, 1942a:533; — Smith, 1944:368. *pl. 95, figs. 1–2.*

Throughout the range on the usual host, *Cystoseira osmundacea*, but occasionally on other large brown algae.

HERPOSIPHONIA Nägeli, 1846

KEY TO THE NORTHEAST PACIFIC SPECIES OF *HERPOSIPHONIA*

1. Simple ultimate branchlets with 8 pericentral cells 2
1. Simple ultimate branchlets with 12 pericentral cells ..... **H. verticillata**
   2. Main axes with 8 pericentral cells; segments in main axes over 1.5 times as long as broad ..... **H. grandis**
   2. Main axes with 10–12 pericentral cells; segments less than 1.5 times as long as broad 3
3. Thalli erect, saxicolous; length of most of the compound branchlets increasing with age, giving the thallus a triangular outline ..... **H. rigida**
3. Thalli prostrate, on coralline algae; length of many of the upper compound branchlets remaining equal to or shorter than the simple branchlets, giving the thallus a linear outline ..... **H. parva**

Herposiphonia rigida Gardner, 1927e:100. *pl. 23*; — Smith, 1944:369. *pl. 95, fig. 5*; *pl. 96, fig. 3.*

Throughout the range between MLLW and LLLW levels. Tetrasporic in July.

Herposiphonia parva Hollenberg, 1943:575. *figs. 8–9.*
Herposiphonia pygmaea Smith, 1944:369. *pl. 96, fig. 2.*

On *Bossea* (*MD 4199*) at LHLW levels, Sunset Bay, in December.

AMPLISIPHONIA Hollenberg, 1939

Amplisiphonia pacifica Hollenberg, 1939:380. *figs. 1–13*; — Smith, 1944:372. *pl. 96, figs. 7–9.*

Known in Oregon only from sterile and tetrasporic specimens (*e.g.*, *MD 4110*) collected from several Cape Arago stations in December and January. It grows on rocks and algal holdfasts between MLLW and LLLW and probably also at lower levels.

LAURENCIA Lamouroux, 1813

Laurencia spectabilis Postels & Ruprecht, 1840:16; — Smith, 1944:377. *pl. 97, figs. 4–5.*

Throughout the range below the HHLW level, but thalli above the MLLW level dwarfed.

JANCZEWSKIA Solms-Laubach, 1877

Janczewskia Gardneri Setchell & Guernsey, *in* Setchell, 1914a:12; — Smith, 1944: 381. *pl. 98, fig. 1.*

Parasitic on *Laurencia spectabilis* found at South Bay (*MD 4101*, De-

cember) and cast ashore on the same host south of Chetco Cove (*MD 6142b*, July).

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LITERATURE CITED

Agardh, C. A. 1820. Species Algarum. **1**(1): 1–168. Stockholm.
———. 1822. Species Algarum. **1**(2): 169–531. Stockholm.
———. 1824. Systema Algarum. 312 pp. Lund.
———. 1828. Species Algarum. **2**(1): 1–189. Stockholm.
———. 1846. Incones Algarum Europearum (see J. G. Agardh, 1846).
[Setchell & Gardner, 1920b: 307, give various earlier dates for issuance in separate parts between 1828 and 1835. This author has seen only the whole work issued together in 1846.]

Agardh, J. G. 1846. C. A. Agardh. Icones Algarum Ineditae. Ed. nova. 4 pp. 20 pls. Lund.
———. 1847. Nya algar från Mexico. Ofvers. K. Svensk. Vet. Akad. Förhandl. **1847**(1): 5–17.
———. 1848. Species Genera et Ordines Algarum. **1**:1–363. Lund.
———. 1851. Species Genera et Ordines Algarum. **2**:1–351. Lund.
———. 1852. Species Genera et Ordines Algarum. **2**(2): 337–720. Lund.
———. 1867. De Laminarieis. Lunds Univ. Årsskr. **4:** 1–36.
———. 1872. Bidrag till Floridearnes systematik. *Ibid.* **8**(6): 1–60.
———. 1876. Species Genera et Ordines Algarum. **3**(1). Epicrisis Systematis Floridearum. 724 pp. Lund.
———. 1883. Till algernes systematik. Nya bidrag. 3d afdel. Lunds Univ. Årsskr. **19:** 1–177. 4 pls.
———. 1884–1885. Till algernes systematik. Nya bidrag. 4th afdel. *Ibid.* **21:** 1–117. 1 pl.
———. 1892. Analecta Algologica. 182 pp. 3 pls. Lund.
———. 1894. Analecta Algologica. Continuatio II. 98 pp. 1 pl. Lund.
———. 1898. Species Genera et Ordines Algarum. **3:**(3). De Dispositione Delesseriearum Mantissa Algologica. 239 pp. Lund.
———. 1899. Analecta algologica. Continuatio V. Lunds Univ. Årsskr. **35:** 1–160. 3 pls.

Ahlner, K. 1877. Bidrag till Kännedomen om de Svenska Formerna af Algslägtet *Enteromorpha*. Akad. Afhandl. 51 pp. 1 pl. Stockholm.

Anderson, C. L. 1891. List of California marine algae, with notes. Zoe **2:** 217–225.

Areschoug, J. E. 1842. Algarum minus rite cognitarum pugillus primus. Linnaea **16:** 225–236.
———. 1847. Phycearum, quae in maribus Scandinaviae crescunt, enumeratio. Sectio prior Fucuceas [*sic*] continens. Nova Acta Reg. Soc. Sci. Upsaliensis **13:** 223–382. 9 pls.
———. 1850. Phycearum, quae in maribus Scandinaviae crescunt, enumeratio. Sectio posterior Ulvaceas continens. *Ibid.* **14:** 385–454. 3 pls.
———. 1866. Observationes Phycologicae. Pt. 1. De Confervaceis Nonnullis. *Ibid.* Ser. 3, **6**: 26 pp. 4 pls. Upsala.
———. 1883. Observationes phycologicae. Pt. 4. De Laminariaceis nonnullis. *Ibid.* Ser. 3, **12**: 23 pp.

Batters, E. A. L. 1900. New or critical British marine algae. Jour. Bot. **38:** 369–379. 1 pl.
———. 1902. A catalogue of the British marine algae. *Ibid.* **40** (suppl. 1): 1–107.

Bauhin, Johann. 1651. Historia Plantarum Universalis. **3.** 882 pp. Embrun.

Berkeley, M. J. 1843. *In* **Sowerby, J.** Supplement to the English Botany of the late Sir J. E. Smith and Mr. Sowerby . . . by W. J. Hooker [and others] **3:** pl. 2866. London.

Blankinship, J. W. & C. A. Keeler. 1892. On the natural history of the Farallon Islands. Zoe **3:** 144–165.

Bliding, Carl. 1938. Studien über Entwicklung und Systematik in der Gattung *Enteromorpha*. I. Bot. Notiser **1938:** 83–90.

————. 1939. Studien über Entwicklung und Systematik in der Gattung *Enteromorpha*. II. *Ibid.* **1939:** 134–144.

————. 1944. Zur Systematik der Schwedischen Enteromorphen. *Ibid.* 1944: 331–356. 26 figs.

Bornet, E. & C. Flahault. 1888. Note sur deux nouveaux genres d'algues perforantes. Jour. de Bot. **2:** 161–165.

Bory de Saint Vincent, J. B. 1926. Macrocyste *in* Dictionnaire Classique d'Histoire Naturelle **10:** 8–10. Paris.

Collins, F. S. 1906. New species, etc., issued in the Phycotheca Boreali-Americana. Rhodora **8:** 104–113.

————. 1909a. New species of *Cladophora*. Rhodora **11:** 17–20. 1 pl.

————. 1909b. The green algae of North America. Tufts College Stud. (Sci. Ser.) **2:** 79–480. 18 pls.

————. 1918. The green algae of North America, second supplementary paper. *Ibid.* **4**(7): 1–106. 3 pls.

Collins, F. S., I. Holden & W. A. Setchell. 1895–1919. Phycotheca Boreali-Americana. Exsiccati Fascicles 1–46 and A–E. Malden, Mass.

Dawson, E. Y. 1944. The marine algae of the Gulf of California. Allan Hancock Pacific Expeditions **3**(10): 189–453. pls. 31–77.

Decaisne, J. & G. Thuret. 1845. Recherches sur les anthéridies et les spores de quelques *Fucus*. Ann. Sci. Nat. (Bot.) Ser. 3, **3:** 1–15. pls. 1–2.

Derbès, A. & A. J. J. Solier. 1856. Mémoire sur quelques points de la physiologie des algues. Suppl. aux Compt. Rend. Acad. Sci. Paris **1:** 1–120. 23 pls.

De Toni, G. B. 1900. Sylloge Algarum **4**(2): 387–773. Padua.

————. 1903. Sylloge Algarum **4**(3): 775–1525. Padua.

De Toni, J. 1936. Noterelle di Nomenclature Algologica. VII. Primo Elenco di Floridee Omonime. Brescia.

[The only copy of this paper seen by the author was in the form of an 8 page impression on an uncut fascicle, the pages of which were not numbered. In this author's opinion this should not be considered a legitimate publication.]

Doty, M. S. 1946. Critical tide factors that are correlated with the vertical distribution of marine algae and other organisms along the Pacific Coast. Ecology **27:** 315–328. 6 figs.

Drew, Kathleen. 1928. A revision of the genera *Chantransia*, *Rhodochorton*, and *Acrochaetium*. Univ. Calif. Plub. Bot. **14:** 139–224. 12 pls.

Esper, E. J. C. 1797–1802. Icones Fucorum. 132 pp. 177 pls. Nürnberg.

Falkenberg, P. 1901. Die Rhodomelaceen des Golfes von Neapel und der Angrenzenden Meeres-Abschnitte. *Fauna und Flora des Golfes von Neapel*, etc. Monographie **26**. 753 pp. 10 figs. 24 pls. Berlin.

Farlow, W. G. 1875. List of the marine algae of the United States, with notes on new and imperfectly known species. Proc. Amer. Acad. Arts & Sci. **10** (n. s. **2**): 351–380.

————. 1877. On some algae new to the United States. *Ibid.* **12** (n. s. **4**): 235–245.

————. 1881. The marine algae of New England. Rept. U. S. Comm. Fish & Fisheries 1879, Appendix A–1. 210 pp. 15 pls.

————. 1889. On some new or imperfectly known algae of the United States. I. Bull. Torrey Bot. Club **16:** 1–12. 2 pls.

Farlow, W. G., C. L. Anderson & D. C. Eaton. 1877–1889. Algae Exsiccatae Americae Borealis. Fascicles 1–5.

Foslie, M. H. 1887. Nye havsalger. Tromsø Mus. Aarshefter **10**: 175–195. 3 pls.
———. 1902. New species or forms of Melobesieae. K. Norske Vidensk. Selsk. Skr. **1902**(2): 1–11.
———. 1903. Two new *Lithothamnia*. *Ibid.* **1903**(2): 1–4.
———. 1906. Algologiske Notiser II. *Ibid.* **1906**(2): 1–28.
———. 1907a. Algologiske Notiser III. *Ibid.* **1907**(8): 1–34.
———. 1907b. Algologiske Notiser IV. *Ibid.* **1907**(6): 1–30.
———. 1909. Algologiske Notiser VI. *Ibid.* **1909**(2): 1–63.
Fries, E. 1835. Corpus Florarum Provincalium Sueciae. I. Floram Scanicum. 394 pp. Upsala.
Gardner, N. L. 1909. New Chlorophyceae from California. Univ. Calif. Publ. Bot., **3:** 371–375. 1 pl.
———. 1913. New Fucaceae. *Ibid.* **4:** 317–374. 18 pls.
———. 1917. New Pacific Coast marine algae. I. *Ibid.* **6:** 377–416. 5 pls.
———. 1919. New Pacific Coast marine algae. IV. *Ibid.* **6:** 487–496. 1 pl.
———. 1922. The genus *Fucus* on the Pacific Coast of North America. *Ibid.* **10:** 1–180. 60 pls.
———. 1926. New Rhodophyceae from the Pacific Coast of North America. I. *Ibid.* **13:** 205–226. 7 pls.
———. 1927a. New Rhodophyceae from the Pacific Coast of North America. II. *Ibid.* **13:** 235–272. 12 pls.
———. 1927b. New Rhodophyceae from the Pacific Coast of North America. III. *Ibid.* **13:** 333–368. 13 pls.
———. 1927c. New Rhodophyceae from the Pacific Coast of North America. IV. *Ibid.* **13:** 373–402. 11 pls.
———. 1927d. New Rhodophyceae from the Pacific Coast of North America. V. *Ibid.* **13:** 403–434. 10 pls.
———. 1927e. New Rhodophyceae from the Pacific Coast of North America. VI. *Ibid.* **14:** 99–138. 17 pls.
———. 1927f. New species of *Gelidium* on the Pacific Coast of North America. *Ibid.* **13:** 273–318. 19 pls.
Greville, R. K. 1824. Scottish Cryptogamic Flora. **2.** 60 pls. Edinburgh.
———. 1830. Algae Britannicae. 218 pp. 19 pls. Edinburgh.
Griggs, R. F. 1906. *Renfrewia parvula*, a new kelp from Vancouver Island. Postelsia **2:** 247–274. 4 pls.
Hamel, G. 1931. Chlorophycées des côtes françaises. Rev. Algol. **6:** 9–73.
Hariot, P. 1889. Algues *in* Mission scientifique du Cap. Horn, 1882–1883. **5**. Botanique. 109 pp. 9 pls. Paris.
Harvey, W. H. 1833a. Algae *in* Hooker & Arnott's Botany of Captain Beechey's Voyage. pp. 163–165. London.
———. 1833b. Algae Confervoideae *in* W. J. Hooker. British Flora **2**(1): 322–385.
———. 1841 Algae *in* Hooker & Arnott's Botany of Captain Beechey's Voyage. pp. 406–409. London. [Supplementary records from additional collections from Monterey and San Francisco Bay made by Douglas and Sinclair.]
———. 1847. Nereis Australis. 124 pp. 50 pls. London.
———. 1849. Phycologia Britannica **2.** pls. 121–240. London.
———. 1853. Nereis Boreali-Americana. Part II. Rhodospermeae. Smithsonian Contr. to Knowledge **4**(5): 1–258. pls. 13–36.
———. 1858. Nereis Boreali-Americana. Part III. Chlorospermeae. *Ibid.* **10**(2): 1–140. pls. 37–50.
———. 1862. Notice of a collection of algae made on the northwest coast of North America, chiefly at Vancouver's Island, by David Lyall, Esq., M.D., R.N., in the years 1859–1861. Jour. Linn. Soc. Bot. **6:** 157–177.
Harvey, W. H. & J. W. Bailey. 1851. Descriptions of seventeen new species of algae, collected by the United States Exploring Expedition. Proc. Boston Soc. Nat. Hist. **3:** 370–373.

Hazen, T. E. 1902. The Ulotrichaceae and Chaetophoraceae of the United States. Mem. Torrey Bot. Club **11:** 135–250. 23 pls.

Hervey, A. B. 1881. Sea Mosses. 281 pp. 20 pls. Boston. [This volume was reprinted in New York by the Orange Judd Company in 1882, from the same type, but with different front pages.]

Hollenberg, G. J. 1939. A morphological study of *Amplisiphonia*, a new member of the Rhodomelaceae. Bot. Gaz. **101:** 380–390. 13 figs.

————. 1942a. Phycological notes. I. Bull. Torrey Bot. Club **69:** 528–538. 15 figs.

————. 1942b. An account of the species of *Polysiphonia* on the Pacific Coast of North America I. *Oligosiphonia*. Amer. Jour. Bot. **29:** 772–785. 21 figs.

————. 1943. New marine algae from Southern California. II. *Ibid.* **30**(8): 571–579.

————. 1944 An account of the species of *Polysiphonia* on the Pacific Coast of North America. II. *Polysiphonia*. *Ibid.* **31**(8): 474–482. 21 figs.

Howe, M. A. 1914. The marine algae of Peru. Mem. Torrey Bot. Club **15:** 1–185. 44 figs. 66 pls.

Hus, H. T. A. 1900. Preliminary notes on west-coast Porphyras. Zoe **5:** 61–70.

————. 1902. An account of the species of *Porphyra* found on the Pacific Coast of North America. Proc. Calif. Acad. Sci., 3d ser., **2:** 173–240. 3 pls.

Kjellman, F. R. 1872. Bidrag till kännedomen om Skandinaviens Ectocarpeer och Tilopterider. 112 pp. 2 pls. Stockholm.

————. 1883. The algae of the Arctic Sea. K. Svensk. Vetensk. Akad. Handl. **20**(5): 1–350. 31 pls.

————. 1889. Undersökning af några till slägtet *Adenocystis* Hook. fil. et Harv. Hanförda Alger. Bihang K. Svensk. Vetensk. Akad. Handl. **15**(Afd. 3, no. 1): 1–20. 1 pl.

Kützing, F. T. 1833. Algologische Mittheilungen. Flora **16:** 513–521.

————. 1843. Phycologia Generalis. 458 pp. 80 pls. Leipzig.

————. 1845. Phycologia Germanica. 340 pp. Nordhausen.

————. 1849. Species Algarum. 922 pp. Leipzig.

————. 1854. Tabulae Phycologicae. **4:** 23 pp. 100 pls. Nordhausen.

————. 1856. *Ibid.* **6:** 30 pp. 100 pls.

————. 1859. *Ibid.* **9:** 42 pp. 100 pls.

Kylin, H. 1907. Studien über die Algenflora der schwedischen Westküste. Akad. Abhandl. 288 pp. 7 pls. 1 map. text figs. Upsala.

————. 1924. Studien über die Delesseriaceen. Lunds Univ. Årsskr., n.f., **20**(6): 1–111. 80 figs.

————. 1925. The marine red algae in the vicinity of the biological station at Friday Harbor, Wash. *Ibid.* **21**(9): 1–87. 47 figs.

————. 1928. Entwicklungsgeschichtliche Florideenstudien. *Ibid.* **24**(4): 1–127. 64 figs.

————. 1930a. Über die Entwicklungsgeschichte der Florideen. *Ibid.* **26**(6): 1–103. 56 figs.

————. 1930b. Über Heterogamie bei *Enteromorpha intestinalis*. Ber. Deutsch. Bot. Ges. **48:** 458–464. 1 fig.

————. 1931. Die Florideenordnung Rhodymeniales. Lunds Univ. Årsskr. n.f. **27**(11): 1–48. 8 figs. 20 pls.

————. 1932. Die Florideenordnung Gigartinales. *Ibid.* **28**(8): 1–88. 22 figs. 28 pls.

————. 1935. Zur Nomenklatur einiger Delesseriaceen. Förhandl. K. Fysiografiska Sellsk. Lund **5**(23): 1–5.

————. 1941. Californische Rhodophyceen. Lunds Univ. Årsskr. n.f. **37**(2): 1–51. 7 figs. 13 pls.

Lamouroux, J. V. 1809. Mémoire sur trois nouveaux genres de la famille des algues marines. Jour. de Bot. **2:** 129–135. 1 pl.

————. 1813. Essai sur les genres de la famille des thalassiophytes non articulées. Ann. Mus. d'Hist. Nat. Paris **20:** 21–47, 115–139, 267–293. 7 pls.

LeJolis, A. 1863. Liste des algues marines de Cherbourg. Mem. Soc. Sci. Nat. Cherbourg **10:** 1–168. 6 pls.

Levring, T. 1939. Über die Phaeophyceengattungen *Myriogloia* Kuck. und *Haplogoia* nov. gen. Bot. Notiser **1939:** 40–52. 2 figs.

Link, H. P. 1820. Epistola . . . de algis aquaticis in genera disponendis, *in* Nees von Esenbeck. Horae Physicae Berolinenses. pp. 1–8, 1 pl. Berlin.

Linné, C. von. 1753. Species Plantarum. Ed. 1. 1200 pp. Stockholm.

Lyngbye, H. C. 1819. Tentamen Hydrophytologiae Danicae. 248 pp. 70 pls. Copenhagen.

Manza, A. V. 1937a. The genera of the articulated corallines. Proc. Nat. Acad. Sci. of U. S. A., **23:** 44–48.

————. 1937b. Some North Pacific species of articulated corallines. *Ibid.* **23:** 561–567.

————. 1940. A revision of the genera of articulated corallines. Philippine Jour. Sci. **71:** 239–316. 20 pls.

Mertens, H. 1829. Zwei botanisch-wissenschaftliche Berichte vom Dr. Heinrich Mertens. . . . Erst Bericht über verschiedene *Fucus*-Arten an der Vater, Prof. Mertens in Bremen. Linnaea **4:** 43–48.

Montagne, J. F. C. 1842. Centurie III de plantes cellùlaires. Ann. Sci. Nat. (Bot.) Sér. 2, **18:** 241–282.

————. 1850. Cryptogamia Guyanensis. *Ibid.* Sér. 3, **14:** 283–309.

Nägeli, C. W. von. 1861. Beiträge zur Morphologie und Systematik der Ceramiaceae. Sitzungsber. Bayerisch. Akad. Wiss. **2**: 297–415.

Nordstedt, O. 1886. Some remarks on British submarine Vaucheriae. 4 pp. 11 figs. Perth.

Nott, C. P. 1900. *Nitophylla* of California. Proc. Calif. Acad. Sci., 3d. ser., **2:** 1–62. 9 pls.

Papenfuss, G. F. 1944. Notes on algal nomenclature. III. Miscellaneous species of Chlorophyceae, Phaeophyceae and Rhodophyceae. Farlowia **1:** 337–346.

————. 1945. Review of the *Acrochaetium-Rhodochorton* complex of the red algae. Univ. Calif. Publ. Bot. **18**(14): 299–344.

Postels, A., & F. Ruprecht. 1840. Illustrationes Algarum in Itinere circa Orbem. . . . Exsecuto in Oceano Pacifico Imprimis Septentrionali ad Littora Rossica Asiatico-Americana Collectarum. 22 pp. 40 pls. St. Petersburg.

Reed, Minnie. 1902. Two new Ascomycetous fungi parasitic on marine algae.. Univ. Calif. Publ. Bot. **1:** 141–164. pls. 15–16.

Reinke, J. 1903. Studien zur vergleichenden Entwicklungsgeschichte der Laminariaceen. 67 pp. 16 figs. Kiel.

Rosenvinge, L. K. 1893. Grønlands Havalger. Meddelser om Grønland, **3:** 765–981. 57 figs. 2 pls.

————. 1900. Note sur une Floridée serienne (*Rhodochorton islandicum* nov. sp.). Bot. Tidsskr. **23:** 61–81.

————. 1909. Marine algae of Denmark 1 Rhodophyceae. K. Danske Vidensk. Selsk. Skrifter, Naturv. og. Mathem. **7**(1): 1–151.

Ruprecht, F. J. 1851. Tange des Ochotskischen Meeres *in* A. T. Middendorff, Sibirische Reise. **1**(2): 193–435. pls. 8–19. St. Petersburg.

————. 1852. Neue oder unvollständig bekannte Pflanzen aus dem nördlichen Theile des stille Oceans. Mém. de l'Acad. St. Petersburg Sci. Nat. **7:** 57–82. 8 pls.

Sanborn, E. I. & M. S. Doty. *Ined.* An annotated list of the marine algae from the Cape Arago and the Coos Bay regions of Oregon. Oregon State Monographs. Studies in Botany. No. 8. 1944.

Saunders, De. A. 1895. A preliminary paper on *Costaria* with description of a new species. Bot. Gaz. **20:** 54–57. 1 pl.

————. 1898. Phycological memoirs. Proc. Calif. Acad. Sci. Ser. 3, **1:** 147–168. 21 pls.

————. 1901. Papers from the Harriman Alaska Expedition. XXV. The algae. Proc. Washington Acad. Sci. **3:** 391–486. 20 pls.

Schmitz, F. & P. Hauptfleisch. 1896–1897. Rhodophyceae, *in* Engler, A. & K. Prantl, Die natürlichen Pflanzenfamilien. Teil 1, Abt. **2:** 298–544. 97 figs.

Schrader, H. F. 1903. Observations on *Alaria nana* sp. nov. Minn. Bot. Stud. **3:** 157–165. 4 pls.

Setchell, W. A. 1901. Notes on algae. I. Zoe **5:** 121–129.

————. 1905. Regeneration in kelps. Univ. Calif. Publ. Bot. **2:** 139–168. 3 pls.

————. 1908. Critical notes on Laminariaceae Nuov. Notar. **19:** 90–101.

————. 1912. Algae novae et minus cognitae. Univ. Calif. Publ. Bot. **4:** 229–268. 7 pls.

————. 1914a. Parasitic Florideae. I. *Ibid.* **6:** 1–34. 6 pls.

————. 1914b. The *Scinaia* assemblage. *Ibid.* **6:** 79–152. 7 pls.

————. 1923a. Parasitic Florideae. II. *Ibid.* **10:** 393–396.

————. 1923b. A revision of the west North American species of *Callophyllis*. *Ibid.* **10:** 397–401.

Setchell, W. A. & N. L. Gardner. 1903. Algae of northwestern America. *Ibid.* **1:** 165–418. 21 pls.

————. 1920a. Phycological contributions. I. *Ibid.* **7:** 279–324. 11 pls.

————. 1920b. The marine algae of the Pacific Coast of North America. Part 2, Chlorophyceae. *Ibid.* **8:** 139–374. 25 pls.

————. 1922a. Phycological contributions. II. New species of Myrionema. *Ibid.* **7:** 334–352. 3 pls.

————. 1922b. Phycological contributions. III. New species of *Compsonema*. *Ibid.* **7:** 353–376. 5 pls.

————. 1922c. Phycological contributions. IV. New species of *Hecatonema*. *Ibid.* **7:** 377–384. 2 pls.

————. 1922d. Phycological contributions. V. New species of *Pylaiella* and *Streblonema*. *Ibid.* **7:** 385–402. 3 pls.

————. 1922e. Phycological contributions. VI. New species of *Ectocarpus*. *Ibid.* **7:** 403–426. 5 pls.

————. 1924. Phycological contributions. VII. *Ibid.* **13:** 1–13.

————. 1925. The marine algae of the Pacific Coast of North America. Part 3. Melanophyceae. *Ibid.* **8:** 383–898. 74 pls.

————. 1933. A preliminary survey of *Gigartina*, with special reference to its Pacific North American species. *Ibid.* **17:** 255–340. 20 pls.

————. 1937. *Iridophycus* in the northern hemisphere. Proc. Nat. Acad. Sci. U. S. A. **23:** 169–174.

Setchell, W. A. & Lucille R. Mason. 1943. New or little-known crustose corallines of Pacific North America. *Ibid.* **29:** 92–97.

Sjöstedt, Gunnar. 1939. Enteromorphastudien. Sv. Bot. Tidskr. **33:** 17–63.

Skottsberg, C. 1922. Notes on Pacific Coast algae. II. On the Californian *Delesseria quercifolia*. Univ. Calif. Publ. Bot. **7:** 427–436. 1 pl.

Smith, G. M. 1942. Notes on some brown algae from the Monterey Peninsula, California. Amer. Jour. Bot. **29:** 645–653. 13 figs.

————. 1944. Marine Algae of the Monterey Peninsula, California. 622 pp. 98 pls. Stanford University, Calif.

Smith, G. M. & G. J. Hollenberg. 1943. On some Rhodophyceae from the Monterey Peninsula, California. Amer. Jour. Bot. **30:** 211–222. 30 figs.

Stackhouse, J. 1797. Nereis Britannica, Continens Species Omnes Fucorum in Insulis Britanicis Crescentium. Fasc. **2:** IX–XVIII. Bath.

————. 1809. Tentamen marino-cryptogamicum. Mém. Soc. Natural. (Moscow) **2:** 50–97.

Strömfelt, H. F. G. 1886. Om Algvegetationen vid Islands Kuster. Akad. Afhandl. 89 pp. 3 pls. Göteborg.

Taylor, W. R. 1937. Marine algae of the northeastern coast of North America. Univ. Michigan Stud. Sci. Ser. **13:** 1–427. 60 pls.

————. 1942. Caribbean marine algae of the Allan Hancock Expedition, 1939. Allan Hancock Atlantic Expeditions. Report no. 2. 193 pp.

Thuret, G. 1854a. Recherches sur la fecondation des Fucacées, suivies d'observations sur les antheridies des algues. Ann Sci. Nat. (Bot.), ser. 4, **2:** 197–214. 4 pls.

————. 1854b. Note sur la synonymie des *Ulva lactuca* et *latissima*, L., suivie de quelques remarques sur la tribu des Ulvacées. Mém. Soc. Sci. Nat. Cherbourg **2:** 17–32.

————. 1854c. [Sur quelques algues nouvelles decouvertes aux environs de Cherbourg.] Mém. Soc. Sci. Nat. Cherbourg **2:** 387–389.

Tilden, J. E. 1900. American Algae. Century IV.

Turner, D. 1808. Historia fucorum. **1.** 164 pp. 71 pls. London.

————. 1819. Historia fucorum. **4.** 153 pp. 60 pls. London.

Wille, N. 1901. Studien über Chlorophyceen. V, VII. Vidensk. Selsk. Skr. Christiania (Mat.-Nat. Kl.), **1900**(6): 22–28, 34–41. 3 pl.

Wilson, Harriet L. 1910. *Gracilariophila*, a new parasite on *Gracilaria confervoides*. Univ. Calif. Publ. Bot. **4:** 75–84. 2 pls.

Wittrock, V. B. 1866. Försök till en Monographi öfver Algslägtet *Monostroma*. Akad. Afhandl. 66 pp. 4 pls. Upsala.

Wittrock, V. B. & O. Nordstedt. 1877–1903. Algae Aquae Dulcis Exsicc. . . . Exsiccati Fascicles 1–35. Upsala.

Woronin, M. 1869. Beitrag zur Kenntniss der Vaucherien. Bot. Zeit. **27:** 157. pl. 2. figs. 30–32.

Yendo, K. 1919. A monograph of the genus *Alaria*. Jour. Coll. Sci., Imp. Univ. Tokyo **43**(1): 1–145. 19 pls.

EXPLANATION OF PLATE 11

The name and number in parentheses after the specific name identifies the material from which the photographs were made. The magnification is indicated at the end of each figure description.

Fig. A. *Callophyllis oregona* (*MD 2594*, **type** *Dudley Herb. 306925*). × 0.46.
Fig. B. *Gloiopeltis furcata* (*MD 6133*). × 0.56.
Fig. C. *Iridophycus oregonum* (*MD 4056*, **type** *Dudley Herb. 306918*). × 0.28.

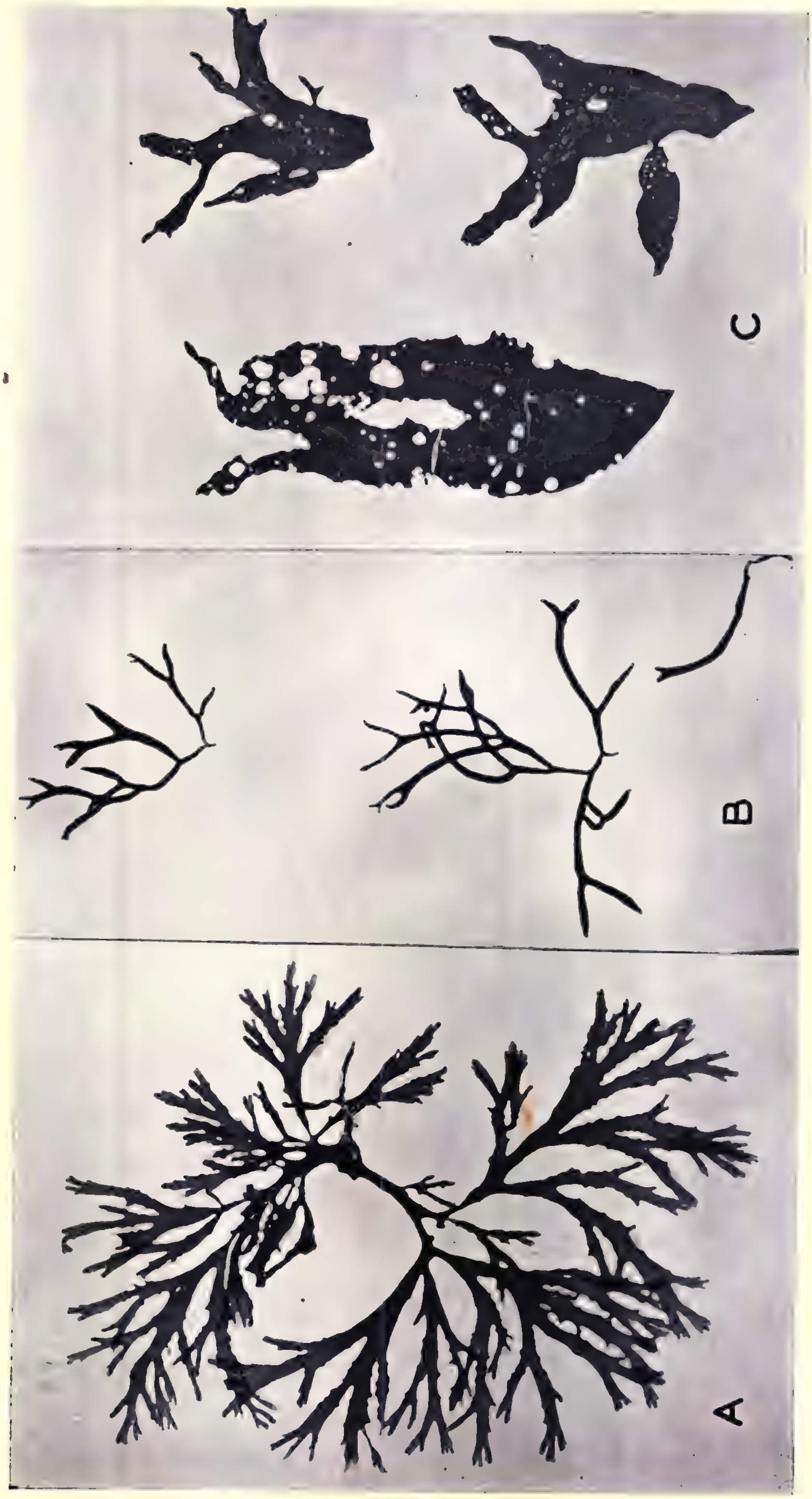

PLATE 11

EXPLANATION OF PLATE 12

The name and number in parentheses after the specific name identifies the material from which the photographs were made. The magnification is indicated at the end of each figure description.

Fig. A. *Fryeella Gardneri* (*MD 5018*). Both tetrasporic and cystocarpic fronds. × 0.5.

Fig. B. *Zanardinula Kylinii* (*C. L. Doty 2440*, **isotype**). × 0.61

PLATE 12

EXPLANATION OF PLATE 13

The name and number in parentheses after the specific name identifies the material from which the photographs were made. The magnification is indicated at the end of each figure description.

Fig. A. *Zanardinula filiformis* (*MD 2295*). × 0.24.
Fig. B. *Odonthalia oregona* (*MD 6142d*, **type** *Dudley Herb. 306917*). × 0.83.

PLATE 13

EXPLANATION OF PLATE 14

The name and number in parentheses after the specific name identifies the material from which the photographs were made. The magnification is indicated at the end of each figure description.

Fig. A. *Erythrophyllum splendens* (*C. L. Doty 1951*, **type** *Dudley Herb. 306922*). × 0.27.

Fig. B. *Plocamium oregonum* (*MD 6151*, **type** *Dudley Herb. 306916*). × 0.5.

Fig. C. *Hymenena cuneifolia* (*MD 2134*, **type** *Dudley Herb. 306920*). × 0.54.

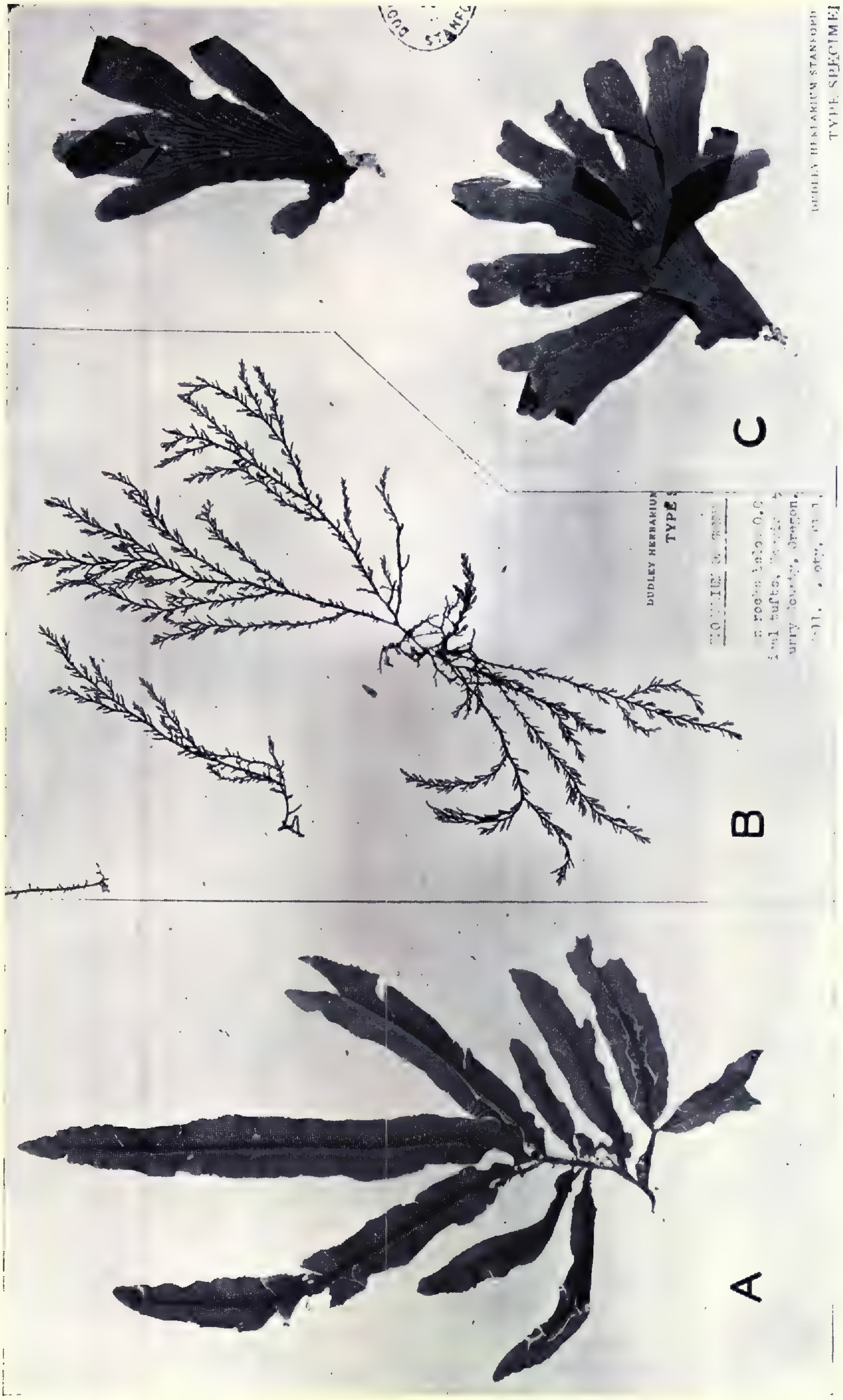

PLATE 14

3(2):217–223 FARLOWIA JULY, 1947

THE HISTORICAL SIGNIFICANCE OF NAMES APPLIED TO REPRODUCTIVE STRUCTURES OF ALGAE

GILBERT M. SMITH

There are various angles from which one may approach the names given reproductive structures of plants. The approach may be etymological and primarily concerned with the derivation of names from classical Greek and Latin. It may be historical and primarily concerned with the dates on which names were proposed. Again, it may be that of the reformer who proposes a substitution of more accurate names for misleading or inaccurate names in current use.

Still another approach, that used in this paper, is the manner in which names, often misnomers, recapitulate development of knowledge concerning the nature of reproductive structures. Discussion of names from this standpoint will be restricted to the algae, both because it is the primary field of interest of the writer, and because many generally used terms were coined to describe reproductive structures of algae.

Study of algae began with Linnaeus' (1743) creation of the order Algae in his Class 24, Cryptogamia. As delimited by Linnaeus this order included both thallose liverworts and true algae; of the latter he recognized four genera — *Chara*, *Fucus*, *Ulva*, and *Conferva*. For more than fifty years botanists describing new species referred them to one of the four Linnaean genera. The climax of this procedure was achieved by Dawson Turner (1809–1818) when he wrote a four volume treatise on the species of *Fucus*. Shortly before 1800 botanists began to recognize other genera than the sacred four of Linnaeus. The first attempts to group these genera into families and orders were solely on the basis of such vegetative characters as form, size, and structure of the thallus. Thus, filamentous genera (called articulate algae) were grouped together irrespective of whether they were green, blue-green, red, or brown algae. The present-day segregation of green, red, and brown algae into separate groups was first proposed by Harvey (1836) when he created what he called the Chlorospermeae, Rhodospermeae, and Melanospermeae. One by one phycologists began to follow the lead of Harvey and by the middle of the nineteenth century his system was in almost universal use.

Linnaeus describes reproductive structures of algae in terms of floral morphology. For *Chara* he describes the appearance of the calyx, stamen, pistil, and seed. He is uncertain about the reproduction of *Fucus* and writes "male flowers?" and "female flowers?" For nearly a century botanists followed Linnaeus' practice of using terms borrowed from floral morphology. This is done in the first comprehensive treatise on algae, that of C. A. Agardh (1823). This use of a terminology borrowed from floral morphology was due to a failure to interpret correctly, rather than to a failure to observe correctly. For example, the drawings of Vaucher (1803)

showing the conjugation of what is now called *Spirogyra* compare favorably with those made by freshmen in college today, yet he speaks of the seeds formed by the conjugation of two tubes with a large number of transverse partitions. In *Ectosperma*, now known as *Vaucheria*, he refers to the reproductive organs as anther and seeds.

Early in the nineteenth century botanists began to abandon the use of floral terms in connection with the algae but we still have a carry-over from that archaic terminology in the present-day retention by phycologists of the terms pericarp, involucre, fructification, and fruiting specimens. Abandonment of floral terminology was initiated by J. G. Agardh (1836) when he began calling reproductive bodies spores instead of seeds. However, it should be noted that in borrowing a term first used in connection with mosses (Hedwig, 1787) he applied it indiscriminately to both sexual and asexual structures. Agardh distinguished between motile and non-motile spores but did not give them special names. The term *zoospore*, now so widely used, was coined by Decaisne in 1842. Decaisne applied the name to both sexual and asexual swarmers; later Pringsheim (1855) restricted its use to asexual reproductive bodies. The current terminology for the various types of non-motile spores of algae is in part borrowed from mycology and in part original with phycologists.

When botanists began to write about spores of algae they did not distinguish between spore and sporangium, the latter also a term introduced by Hedwig (1787) to describe a structure found in mosses. Thuret (1850) was the first to differentiate between spore and sporangia of algae. He also noted that brown algae have two distinctive types of sporangium which he named *trichosporangium* and *oosporangium*. Later (1855) he substituted the names *plurilocular sporangium* and *unilocular sporangium* now so widely used in connection with brown algae.

Most of the terminology for structures associated with sexual reproduction of algae dates from the decade 1850–1860. The term *antheridium* was introduced considerably earlier than this by C. A. Agardh (1823) to describe a distinctive type of reproductive organ he observed in *Polysiphonia*. Agardh called this organ an antheridium because of its superficial resemblance to an anther. Within a few years the same name was also used for a reproductive organ found in brown algae. When Derbès and Solier (1850) observed that antheridia liberated motile reproductive bodies, they called them *antherozoids* and considered them zoospores coming from a special type of sporangium, the antheridium. Thuret's classical studies on fertilization in *Fucus*, the illustrations of which are still republished in texts of today, appeared in 1854. He interpreted what he saw as a swarming of antherozoids about a spore, the *octospore*, liberated from a sporangium of *Fucus*. Fusion of antherozoid with the octospore activated the octospore to develop into a new plant. The next year (1855) Pringsheim described fertilization in *Vaucheria* but thought that it resulted in a spore fruit (Sporenfrucht). In 1858 Pringsheim distinguished between male and female organs of *Oedogonium* and proposed the name *oogonium* for the

latter. He decided against calling the contents of the oogonium an egg because he considered it different from the egg of an angiosperm. Pringsheim called the contents of an oogonium the fertilization sphere or *gonosphere*. He said that a single seed body united with a gonosphere to form the fertilized cell or seed cell, and called this the *oospore*. In the same year that Pringsheim introduced the term oospore, DeBary (1858) recognized the fact that conjugation in *Spirogyra* is essentially the same as sexual reproduction in *Oedogonium* or *Vaucheria*, and he named the body produced by conjugation of two *Spirogyra* cells the *zygospore*. A union of two motile swarmers was first described by Pringsheim in 1870. He and all others who described the process during the next few years speak of it as a fusion of two zoospores to form an oospore or a zygospore.

The terms zygospore and oospore perpetuate the erroneous idea that fertilization results in the formation of a spore-like body. In 1877 DeBary and Strasburger gave a new interpretation of the phenomenon and proposed a new terminology. They called the two fusing cells *gametes* and named the fusion product the *zygote*. The cell producing the gametes was called the *gametangium*. DeBary and Strasburger restricted this terminology to the cases where the two gametes are of similar size, but they differentiated between a fusion of flagellated gametes (*planogametes*) and of non-flagellated gametes (*aplanogametes*). Five years later Falkenberg (1882) extended this concept by recognizing the gametic nature of eggs and antherozoids and substituting the term zygote for the term oospore. He distinguished between a fusion of similar and dissimilar gametes by calling the former *isogamy* and the latter *oogamy*.

Reproductive organs of red algae differ so markedly from those of other algae that they are given special names. At first, as with other algae, the reproductive structures were considered floral in nature. Thus, Ellis (1757) described the pedunculate flowers and catkins of a filamentous alga now referred to the red algae. During the period when reproductive organs were considered fruits, both C. A. Agardh (1823) and Greville (1830) noted that many algae now included among the red algae have two kinds of fruit and that the two are never borne on the same plant. One kind of fruit was called a *capsule*, the other kind a *granule*. Greville was the first to note that the granules are always ternately divided. When J. G. Agardh (1836) began using the name spore in connection with algae he called the ternate granule a *sphaerospore*. In 1842 Decaisne changed this name to *tetraspore*. Both J. G. Agardh and Decaisne thought that they were dealing with a spore divided into four parts or sporules and it was not until 1882 that Falkenberg called each of the four parts a tetraspore.

The distinctive type of reproductive organ that C. A. Agardh (1823) found in *Polysiphonia* and named the antheridium is now known to be a male reproductive organ. Derbès and Solier (1850) thought that the antheridia of certain red algae liberated flagellated reproductive bodies which they called antherozoids. When Bornet and Thuret (1867) showed that

these bodies of red algae lack flagella they called them *antheridial corpuscules* and this term was used until Schmidt (1883) thought them similar to *spermatia* of fungi and called them by that name. Later he (Schmitz *in* Schmitz and Hauptfleisch, 1896) suggested that the individual cell liberating a spermatium be called the *spermatangium* and that the name antheridium be reserved for the cluster of spermatangia.

In 1844 J. G. Agardh introduced the well-known term *cystocarp* as a substitute for the term capsule. For nearly a quarter of a century botanists had no difficulty in recognizing cystocarps but they had no idea of their nature. The nature of the cystocarp was first shown by Bornet and Thuret (1867) when they demonstrated that fertilization in red algae is effected by passive transportation of a male gamete (the antheridial corpuscule or spermatium) to a hair-like outgrowth which they designated as the *trichogyne*. They said that the trichogyne was borne at the apex of a cell, the *carpogonial cell*, terminating a special filament, the *trichophoric apparatus*. In 1883 Schmitz realized that this carpogonial cell is the female sex organ of red algae and named it the *carpogonium* because of the analogy to the oogonium of green algae.

Bornet and Thuret saw that fertilization was followed by development of the cystocarp and that this might involve cells other than the carpogonium. In an attempt to clear up matters they introduced the term *procarp* but this can hardly be considered a step in advance because even today phycologists are still trying to define the term. Most of the remaining terms applied to structures involved in the complicated development of cystocarps were proposed by Schmitz in 1883. Schmitz noted that certain cells adjacent to or remote from the carpogonium were densely filled with cytoplasm. These he called *auxiliary cells*, but he did not distinguish between those purely nutritive in function and those destined to take over the carpogonial function and produce carpospores. Kylin (1928) ended this confusion by calling the purely nutritive cells *nurse cells* and restricting the name auxiliary cell to those producing outgrowths bearing carpospores. Schmitz (1883) proposed the term *ooblastema* to designate the filamentous outgrowths from carpogonia and auxiliary cells. He used this name for two entirely different types of filament: those establishing a connection between carpogonium and auxiliary cell, and the carpospore-producing filaments growing from a carpogonium or from an auxiliary cell. Later he (Schmitz *in* Zerlang, 1889) restricted usage of the term ooblastema to connecting filaments between carpogonia and auxiliary cells, and gave the name *gonimoblast* to the carpospore-producing filaments. Special protective structures surrounding cystocarps are usually called pericarps or involucres. These names date back to the time when reproductive structures of algae were described in terms of floral morphology and serve as a constant reminder of old misconceptions concerning reproduction of algae.

Finally, there is the terminology used to describe the life cycle of algae. As is well known, Hofmeister (1851) described what he called an alternation of generations in bryophytes and pteridophytes. This phrase was first

used by the zoologist Steenstrup (1842) to describe the life cycle of certain coelenterates but it is not clear whether or not Hofmeister borrowed the phrase from him. Most botanists are not aware of the fact that the names now used to designate the two generations do not date from Hofmeister. He writes about "the first generation . . . destined to produce the sexual organs" and states that "the object of the second generation is to form numerous. . . . spores." Within a short time botanists began to call Hofmeister's first generation the sexual generation and his second generation the asexual generation. In 1884 DeBary named the asexual generation the *sporophyte*, and in 1891 Bower called the sexual generation the *gametophyte*.

Shortly after Hofmeister demonstrated the alternation of generations in archegoniates, botanists began to debate the question of the presence of a similar life cycle in algae. The first botanists to discuss this question tried to homologize the thallus of filamentous green algae with the sporophyte and the sex organs with the gametophyte. Interest in the question was revived in 1894 when Strasburger pointed out the difference in chromosome numbers of the two generations. Williams (1903), the first to apply this criterion to algae, found that sexual plants of the brown alga *Dictyota* are haploid and the asexual plants diploid. In speaking of the two generations he calls them gametophyte and sporophyte, a practice universally followed by all others who have found a similar life cycle among green and brown algae.

Application of the terms gametophyte and sporophyte to red algae is a more complicated matter and has been in accordance with the individual investigator's interpretation of the nature of the cystocarp. Oltmanns (1898) called plants bearing antheridia and carpogonia gametophytes and interpreted the cystocarp as a parasitic asexual generation which he called the sporophyte. He called the free-living plant producing tetraspores by the noncommittal name of tetrasporic plant and considered it an accessory generation of the gametophyte. Yamanouchi (1906), the first to study the chromosome cycle in a tetrasporic red alga, used the number of chromosomes as the criterion for differentiating between the two generations, and included both the cystocarp and the tetrasporic plant in the sporophytic generation. The terminology introduced by Church (1919) reconciles the conflict between the morphological and cytological viewpoints. He follows Oltmanns in considering the cystocarp a parasitic asexual generation and calls it the *carposporophyte* irrespective of whether it is haploid or diploid. In those red algae with a free-living tetrasporic plant he calls this the *tetrasporophyte*.

The foregoing account showing the inaccuracy of many morphological terms has not been written as a prelude to a plea for a revised terminology. Even if one could do the impossible and propose a terminology that would go unchallenged it would serve no real purpose because a botanist would have to know both the revised and the old terminology.

This historical survey has been written with two objectives in view. One

objective has been to interest other botanists in a subject that has long been a hobby of the writer, the original meaning of terms used in plant morphology. The second, and more important, objective is to point out the manner in which many terms in current use recapitulate development of knowledge of the nature of reproductive structures of algae; how some terms recall the period when reproduction of algae was thought to be identical with that of flowering plants; how other terms recall the period when reproduction of algae was first recognized as different from that in flowering plants; and how still other terms recall the period before a distinction was made between sexual and asexual reproduction of algae.

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LITERATURE CITED

Agardh, C. A. 1823. Species Algarum. 531 pp. Stockholm.

Agardh, J. G. 1836. Observations sur la propagation des algues. Ann. Sci. Nat. (Bot.) ser. 2, **6:** 193–212. 4 pls.

————. 1844. In Systemata Algarum Hodierna Adversaria. 56 pp. Lund.

Bornet, E. & G. Thuret. 1867. Recherches sur la fécondation des Floridées. Ann. Sci. Nat. (Bot.) Ser. 5, **7:** 137–166. 3 pls.

————. 1878. Études Phycologiques. 105 pp. 51 pls. Paris.

Bower, F. O. 1891. On antithetic as distinct from homologous alternation of generations in plants. Ann. Bot. **4:** 347–370.

Church, A. H. 1919. Historical review of the Florideae. Jour. Bot. **57:** 297–304.

DeBary, A. 1858. Untersuchungen uber die Famille der Conjugaten. 91 pp. 8 pls. Leipzig.

————. 1884. Vergleichende Morphologie und Biologie der Pilze Mycetozoen und Bacterien. 558 pp. Leipzig.

DeBary, A. & E. Strasburger. 1877. Acetabularia mediterranea. Bot. Zeit. **35:** 713–758. 1 pl.

Decaisne, J. 1842. Essais sur une classification des algues et des polypiers calcifères de Lamouroux. Ann. Sci. Nat. (Bot.) Ser. 2, **17:** 297–380. 4 pls.

Derbès, A. & A. J. J. Solier. 1850. Sur les organes reproducteurs des algues. Ann. Sci. Nat. (Bot.) Ser. 3, **14:** 261–282. 6 pls.

Ellis, J. 1757. Sequel to the animal nature of the genus of Zoophytes, called *Corallina*. Phil. Trans. Roy. Soc. London **57:** 421–427. 1 pl.

Falkenberg, P. 1882. Die Algen im weidsten Sinne. *In* A. Schenk, Handbuch der Botanik. **2:** 159–314. 25 fig. Breslau.

Greville, R. K. 1830. Algae Britannicae. 218 pp. 19 pls. Edinburgh.

Harvey, W. H. 1836. Algae. *In* J. T. Mackay, Flora Hibernica. 2 vols. Dublin.

Hedwig, J. 1787–1797. Descriptio et Adumbratio Microscopico-Analytica Muscorum Frondosum. 4 vols. Leipzig.

Hofmeister, W. 1851. Vergleichende Untersuchungen der Keimung, Entfaltung und Fruchtbildung höherer Kryptogamen. 179 pp. 33 pls. Leipzig.

Kylin, H. 1928. Entwicklungsgeschichtliche Florideenstudien. Lunds Univ. Årsskr. N.F. Avd. 2, **24**(4): 1–127. 64 figs.

Linnaeus, C. 1743. Genera Plantarum. ed. 2. 413 pp. Paris.

Oltmanns, F. 1898. Zur Entwickelungsgeschichte der Florideen. Bot. Zeitg. **56:** 99–140. 4 pls.

Pringsheim, N. 1855. Über die Befruchtung der Algen. Monatsber. K. Akad. Wiss. Berlin. **1855:** 133–165. 1 pl.

———————. 1858. Beiträge zur Morphologie und Systematik der Algen. I. Morphologie der Oedogonieen. Jahrb. Wiss. Bot. **1:** 1–81. 6 pls.

———————. 1870. Ueber Paarung von Schwärmsporen, die morphologische Grundform der Zeugung im Pflanzenreiche. Monatsber. K. Akad. Wiss. Berlin. **1869:** 721–738. 1 pl.

Schmitz, F. 1883. Untersuchungen über die Befruchtung der Florideen. Sitzungsber. K. Akad. Wiss. Berlin **1883:** 215–258. 1 pl.

Schmitz, F. & P. Hauptfleisch. 1896. Rhodophyceae. *In* A. Engler & K. Prantl, Die Natürlichen Pflanzenfamilien. **1** (Abt. 2): 298–544. 97 figs.

Steenstrup, J. J. S. 1842. Ueber den Generationswechsel, oder die Fortpflanzung und Entwicklung durch abwechselnde Generationen. 140 pp. 3 pls. Copenhagen.

Strasburger, E. 1894. The periodic reduction of the number of chromosomes in the life history of living organisms. Ann. Bot. **8:** 281–316.

Thuret, G. 1850. Recherches sur les zoospores des algues et les anthéridies des cryptogames. Ann. Sci. Nat. (Bot.) Ser. 3, **14:** 214–260. 16 pls.

———————. 1854. Recherches sur la fécondation des Fucacées, suivies d'observations sur les anthéridies des algues. Ann. Sci. Nat. (Bot.) Ser. 4, **2:** 197–214. 4 pls.

———————. 1855. Recherches sur la fécondation des Fucacées et les anthéridies des algues. Ann. Sci. Nat. (Bot.) Ser. 4, **3:** 1-28. 3 pls.

Turner, D. 1808–1819. Fuci sive Plantarum Fucorum Generi a Botanicis Ascriptarum Icones Descriptiones et Historia. 4 vols. London.

Williams, J. L. 1903. Alternation of generations in the Dictyotaceae. New Phytol. **2:** 184–186.

Vaucher, J. P. 1803. Histoire des Conferves d'Eau Douce. 285 pp. 17 pls. Geneva.

Yamanouchi, S. 1906. The life history of *Polysiphonia violacea*. Bot. Gaz. **42:** 401–449. 10 pls. 3 figs.

Zerlang, O. E. 1889. Entwicklungsgeschichtliche Untersuchungen über die Florideen-Gattungen *Wrangelia* und *Naccaria*. Flora **72:** 371–407. 1 pl.

3(2):225–267 FARLOWIA JULY, 1947

THE GENUS TYLOSTOMA IN INDIA

W. H. LONG AND SULTAN AHMAD

As most of the specimens of the genus *Tylostoma* discussed in this paper were collected from the Panjab Plains, we think it advisable to give data on location, climate, soil and topography of this region, so that our readers can get some idea of the conditions under which these species grew. These data were furnished by the junior author, Sultan Ahmad.

The Panjab occupies the extreme northwest corner of India and comprises nearly the whole region north of Sind and Rajuputana, and west of the Jamna River. In the north it extends beyond the great peaks of the Central Himalayas and embraces the Tibetan Valleys of Lahul and Spiti. On its southern border it encroaches upon the desert of Rajuputana. The main part of the province is a country of doabs (land between rivers) and deserts.

The province represents a great variety of physical features from the snow peaks and glaciers of the Himalayas to the sandy deserts of Bahawalpur; but the major portion forms part of the great alluvial plains of India.

The Panjab may conveniently be divided into the following areas, each of which has a characteristic climate and vegetation: 1. The Plains; 2. The Salt Range; 3. The Sub-Himalayan; 4. The Himalayan Tract.

Of these the Plains constitute the largest and by far the most important part of the Province. They consist of a vast rolling expanse of land characterized by extreme flatness, with a very gentle, almost imperceptible slope toward the southwest, in the direction of the flow of the rivers. At its highest point it is never more than 1000 feet, and at its lowest never more than 500 feet above sea level. The surface on the whole is almost unbroken, except some hillocks of gneiss near Tosham in Hissar and isolated rocks at Kirena, Chiniot and Sangla. The only eminences otherwise are low ridges of wind-blown sand and the "thehs" or mounds which represent the accumulated debris of ancient village sites. The whole area is drained by five rivers, the Jhelum, Chenab, Ravi, Beas and Sutlej. Between the rivers (the doab) there is usually a flat, alluvial plain covered with cultivated fields. During the rainy season the sandy bed of a stream becomes full from bank to bank, and the silt-laden waters spill over into the cultivated lowlands. Sometimes the river may leave its old bed and in a single night destroy miles of fertile fields, cutting for itself a new channel.

On the northwest the Panjab Plains end abruptly against the Salt Range and on the northeast stretch to the foothills of the Himalayas. On the east they fade imperceptibly into the Gangetic Plains. To the south of the Sutlej River, the land begins to rise gradually and becomes drier till it passes into the barren wastes of the Indian Desert.

CLIMATE

The climate is of the monsoon type which is characterized by the seasonal reversal of the winds. Three distinct seasons may be recognized: (a) the "cool dry" season, from mid-October to March; (b) the "hot dry" season from April to mid-June; (c) the "rainy season," from mid-June to mid-October.

The rains cease in the end of September. The days are still warm, but the skies are clear, the air dry, and the nights cool. In October and November the daily range of temperature is very wide, exceeding 30°F., and the fall at sunset very sudden. In winter small but valuable precipitation results from the passing of a series of small storms from the west. The clouds begin to gather before Christmas, but the rain often holds off till January. The central districts receive approximately 1 inch in each of the months January, February and March, mostly from this source. In winter during the nights the temperature on grass falls below 32°F. and for a couple of months there is hoarfrost 5–10°F. The heat begins to be unpleasant in April, and in May and June scorching winds blow and the temperature may rise to 110–120°F.

AVERAGE ANNUAL RAINFALL FOR THE DISTRICTS IN INCHES

Zone	*District*	*Rainfall*	*Zone*	*District*	*Rainfall*
North Central or North Eastern Plain	Gujrat	28	South Western Plain	Gujranwala	24
	Sialkot	35		Lahore	21
	Gurdaspur	35		Shahpur	14
	Hosiarpur	36		Sargodha	14
	Amitsar	24		Jhang	10
	Jullunder	28		Sheikhupura	10
	Ludhiana	28		Lyallpur	10
	Ambala	35		Montgomery	10
				Multan	7
Northwest Plain	Rawalpindi	33		Muzaffargarh	6
	Jhelum	26		Dera Ghazi Khan	6
	Attock	19			
	Mianwali	12	South Eastern Plain	Karnal	30
				Gurgaon	26
				Rohtak	21
				Hissar	16
				Ferozpur	21

The heat is somewhat relieved at times by dust storms accompanied often by rainfall. The monsoon "breaks" in the Panjab by the end of June and ends just after the middle of September. In the monsoon season, the climate is mild only on rainy days but there is great relief by the discontinuance of hot dry scorching wind. But the intense dry heat is healthier and to many less trying than the mugginess of the rainy season. The dust storms which used to be common have become rarer with the spread of canal irrigation in the Southwestern Plain.

It is mainly on a climatic basis that the Panjab Plains can be divided into 4 subregions:

1. *The Northeastern or North Central Plain.* It has a shorter and less severe cold weather than the Northwestern, an earlier and a heavier monsoon, but scantier winter rains. The total rainfall varies from 20–30 inches.

2. *The Northwestern Plain.* It has a longer and colder winter and spring. The total rainfall varies from 16–32 inches. The monsoon rains come late and are much less abundant than in the sub-montane zone. On the other hand the winter rains are heavier than in any part of the province.

3. *The Southwestern Plain.* It includes the driest parts with a rainfall from 5–15 inches. At Multan there are only about 15 days in the whole year on which any rain occurs.

4. *The Southeastern Plain.* Here again the rainfall averages between 20–30 inches, but varies very much from year to year, and the area often suffers from famine.

RAINFALL DURING WINTER AND SUMMER IN INCHES

District	*Monsoon Rain June-September*		*Winter Rain December-March*		*Annual Total*
Gurdaspur	26.94		6.70		35.80
Jullunder	19.56		4.12		25.35
Rawalpindi	19.88		7.35		31.8
Jhelum	13.99		4.58		20.93
Attock	11.99		5.70		20.64
Mianwali	5.96		2.44		9.92
Ambala	27.87		4.35		34.24
Karnal	18.44		2.74		22.67
Rohtak	17.60	av. for 6 yrs.	3.01	av. for 6 yrs.	21.00
Lahore	12.34		2.70		16.30
Lyallpur	8.22		1.66		10.99
Sheikhupura	9.00		1.80		12.00
Sargodha	9.78		3.09		14.64
Montgomery	7.16		1.66		9.55
Multan	4.16		1.08		5.84
D. G. Khan	3.23		1.25		5.40

VEGETATION

The vegetation differs a great deal in the different climatic zones enumerated above. In general when the rainfall drops below 40 or 30 inches it is too dry for the adequate growth of forests. In localities favored as regards soil and underground water supply, even where it is as low as 20 inches per year, good forests of *Dalbergia sissoo* and *Morus alba* are found. Such forests occur especially on the sides of the rivers. Where the rainfall drops below 20 inches the conditions approach those of semi-desert, xerophytic plants becoming important. The whole of the Southwestern Plain and a part of the Southeastern Plain shows this type of vegetation. The soil and climate are adapted to scrub jungle of drought resisting type.

The primitive forests of the Plains consist of *Tamarix articulata*, *Salvadora oleoides*, *Prosopis spicigera* and *Capparis aphylla*. These scrub forests or "Rakhs," which to a very large extent have been brought under cultivation, are fast disappearing from the scene as whatever was left of

them by the original cultivators has been cut for fuel and timber. The only fungus of note in these scrub forests is *Itajahya rosea*, growing near bases of *Salvadora oleoides*. The trees are very old and the leaves and vegetable debris accumulate near their bases, making an ideal habitat for this fungus. It grows there undisturbed from year to year, often in very large quantities.

Another good habitat for small fungi, mostly agarics, is the sides of the water courses. The Gasteromycetes growing on the sides of these are *Lycoperdon echinellum*, *Phallus celebicus*, *Simblum gracile*, and *Protubera maracuja*, in addition to some species of *Tylostoma*.

With the destruction of natural vegetation the unirrigated areas have been converted into bare, sandy wastes which are covered by annual or perennial grasses. These are the ideal places for the growth of numerous species of *Tylostoma*; in addition to these there are found *Geaster* sp., *Schizostoma laceratum* and var. *nigrum*, *Disciseda cervina*, *Simblum gracile* and many small agarics.

During monsoon rains these grassy areas serve as good grazing grounds for cattle. The upper layers of the soil are renewed every year by sand storms which deposit large quantities of sand from the adjacent areas; consequently these areas are at a higher level than the surrounding cultivated fields. Their level is responsible for their preservation in this state as they cannot be irrigated by canal water. In addition to the cultivated fields these sandy tracts are impregnated with salt to form "Kallar," as it is locally called. These saline patches are more or less devoid of any vegetation, excepting *Suaeda fructicosa* and *Salsola foetida*. The only fungus found beneath these bushes is *Schizostoma laceratum* var. *nigrum*.

With the advent of canals, however, the whole flora has undergone a marked change, being more or less entirely replaced by trees of *Acacia arabica*, *Dalbergia sissoo*, *Morus alba* and *Zizyphus jujuba*. Nothing can be said about the change which might have taken place in the fungous flora due to the same cause. It is certain that some of the species growing on the hills have every chance of migrating and settling if environmental conditions suit them. This is more likely to be the case in the sub-montane region where the conditions are not so extreme as lower down in the plains.

The sandy soils also have certain characteristic plants which avoid the less porous soil of the typical Rakhs. Examples of these plants are *Crotolaria burhis*, *Leptadenia spartium* and *Calligonum polygonoides*. The last plant has been seen only in the sandy desert area of the Bahawalpur State. The fungous flora consists of *Phellorina inquinans*, *Podaxon pistillaris*, *Tylostoma volvulatum*, *Terfezia leonis* and *Schizostoma laceratum*. We are sure that intensive collections in the desert regions would yield a large number of *Tylostomas* in due course of time. With the exception of the fungi mentioned above nothing is known about the fungous flora of the sand hills in the south which pass into the great Indian Desert. The junior author had a chance only once of collecting these in the Bahawalpur State.

The two most frequent species in the sandy cultivated fields are *Podaxon pistillaris* and *Lycoperdon pusillum*. These are collected in large quantities during the monsoon period for culinary purposes. The other edible species are *Phellorina inquinans* and *Terfezia leonis*. The former is sold in the Bazaars of Multan, and is also cut into small pieces, dried and stored for future use. *Terfezia leonis* is also kept in this condition and used as a luxury after the rains when the fresh plants are not available. The agarics are hated by the natives and never collected for any purpose whatsoever.

The water-logged areas have a typical aquatic vegetation, the only fungi are a number of agarics and a very unusual species of *Tylostoma* which is discussed later in this article.

SOIL

The main part of the country is a monotonous plain of fertile loam which is of light reddish color in some districts; interspersed with it are also found tracts of stiff clay and loose sand. In the Thal Desert, districts of Jhang, Multan and Hissar and the Bahawalpur State there is a vast expanse of sand forming low sand hills or dunes which keep shifting their position during the daytime.

Tracts impregnated with salts locally known as "Kallar" are widely distributed. The salts are usually chloride, sulphate and carbonate of sodium in varying proportions. These saline patches are usually more or less localized but sometimes occur over vast areas. During the rains these can be recognized by the absence of any kind of vegetation, but in winter the surface becomes covered with white incrustations of salt. Near Ladher in the Sheikhupura district this "Kallar" extends over several miles and water-logging is frequent. It is interesting to note this fact because many of the *Tylostoma* collections come from there. In certain parts the water-logging is a regular nuisance and actually threatens the prosperity of the Province. It is due to excessive use of canal water and defective drainage. More often the cause of water-logging, like the accumulation of salts in the soil ("Kallar") is caused by a hard bed of clay or kankar (argillaceous concretionary nodular limestone), which prevents the percolation of the surface water.

The sandy clay soil of the sandy wastes described above which are not brought under cultivation becomes hard excepting the superficial layer which is trampled over by the grazing animals and made loose by their hoofs. During the summer some soil is also deposited by the sand storms on these areas of waste land. The size of the *Tylostoma* depends on the depth of this superficial loose soil. Under these conditions even the largest species, *Tylostoma volvulatum*, assumes a small stature. We have strong evidence in favor of this view. In one spot the soil was levelled and a large amount removed and deposited on the sides of the fields over waste land nearby. After 2 years a very good crop of *T. volvulatum* was found growing there, some specimens measuring about 20 cm. in total height. When

this area was visited after a number of years the whole soil was covered with small grass and the few specimens of *Tylostoma volvulatum* found measured about 5–8 cm. in height. This change had occurred in a few years, due, apparently, to the hardening of the lower layers of the soil by the gradual percolation of rain water and the trampling of the grazing animals. The same spot was brought under cultivation during the "grow more food" campaign, and as the level was very high as compared to the surrounding area, the rain water could easily drain off into the adjacent soil. The result was that no crop was possible but the ploughing had done a positive good to the soil and the next year very large specimens of *T. volvulatum* were again found growing there. In sandy places also the same phenomenon is observed, the length of the stipe depending on the depth at which the button stage lies. In the beginning the carpophore may start its growth near the surface of the soil but during dust storms, which are very frequent in these places, they may get buried very deep in the sand, and then the stipe elongates enough to expose the peridium above the surface of the soil. The junior author easily proved this fact by putting buttons of *T. volvulatum* at different depths in moist sand in his laboratory. He found that the plants invariably came above the surface of the soil or at least cracked the layers of soil lying above. Further exposure is affected possibly by the shifting of the soil by wind.

CLIMATIC DETAILS OF PLACES LYING OUTSIDE THE PANJAB FROM WHICH *Tylostoma* SPP. HAVE BEEN COLLECTED

Mussoorie (30°28′N., 78°10′E.)

Height above sea level ..... 6000–8000 feet.
Average annual rainfall ..... 110 inches.

It is situated upon one of the outer ranges of the Himalayas which lie to the north of Dehra Dun. The mean maximum temperature ranges from 40°F. to 45°F. and the mean minimum temperature between 30°F. to 35°F. The mean maximum temperature in June, the hottest month, is 75°F. and the mean minimum 60°F. Snow falls in the winter.

Dehra Dun (30°20′N., 78°6′E.)

Height above sea level ..... 2300 feet.
Average annual rainfall ..... 85.5 inches.

It is situated in the midst of a mountain valley 2300 feet above sea level. It enjoys a great reputation as a hill resort.

Delhi (28°39′N., 77°16′E.)

Height above sea level ..... 714 feet.
Average annual rainfall ..... 26.24 inches.

The capital of India lies inside a tiny Province on the west bank of the river Jamna and hence in the Gangetic Plain. On the west there is a low ridge which is merely a spur of the Arawalli Range.

Madras (13°4′N., 18°17′E.)

Height above sea level ..... 67 feet.
Average annual rain fall ..... 50 inches.

Madras lies in the coastal plain of South India, which consists mainly of alluvium. Climatically the whole region is quite distinct from the rest of India. During May to September no part receives more than 20 inches of rain. On the other hand November and December are the wettest months of the year when the remainder of India is almost rainless. The cloudless skies which prevail from January to June result in higher temperatures, and there is the annual range of 14°F. The winters are much warmer and a comparison with Northern India is interesting.

Pusa (26°3′N., 85°30′E.)

Height above sea level ..... 200 feet.
Average annual rainfall ..... 50–55 inches.

It lies in the Middle Ganges Plain in the Bihar Province beside the river Gandak, a tributary of the Ganges. The climate is less extreme than in the Upper Ganges Plain or the Panjab, but it is still cold enough in January (average of 68°F.). In the hot season the scorching winds blowing down the Ganges Valley are still felt, but the heat is less intense than in the Panjab or upper Ganges. In the rainy season the river frequently overflows and causes widespread floods depositing quantities of silt and mud on the surrounding land.

Skardu (35°3′N., 75°6′E.)

Old capital of Baltistan, 7250 feet above sea level.

It is situated in a sandy basin lying on both sides of the Indus River and more than 5 miles in width. The climate of Baltistan is very severe and most of the rivers are frozen in winter. On the other hand near the river on Skardu Plain the heat is intense in July and August. The rainfall is very scanty throughout the area.

Nilgiris

The Nilgiris are on a plateau some 700 square miles and 6500 feet high. This plateau is much broken by high ridges and rocky summits. It is located south of Mysore State and forms the southern end of the Western Ghats. Ootacamound in these hills is a favorite health resort for Europeans, and it is very probable that our plant *Tylostoma exasperatum* was collected in the vicinity of this station. It has an average rainfall of 48 inches and rather mild climate.

The junior author finds that all species growing in sandy soil or sandy loam have a radicating base, while the plants growing in clay soil or in leaf debris have a bulbous base; as the sandy soil is more porous and retains no water, the plants develop the root-like organs for the absorption of water from the lower layers where it is available. The hyphae growing

to form bundles appear to be much more efficient organs of conduction as compared to single hyphae. When they are long and branched they also serve to fix the plants firmly in the loose sandy soil. In the pure clay soil the formation of a rhizomorph is very difficult due to the hard nature of the soil, and indeed it appears to be unnecessary as both the functions enumerated above can be efficiently performed by the simple hyphae. The clay soil can hold and retain a large amount of water and is hard and compact and can serve for the fixing of the plant even when a few hyphae are developed. The same thing holds good for the humus soil which can also retain and absorb large quantities of water. The half-decomposed leaves, if present, further minimize the chance of rhizomorphs. There is a possibility that the hyphae may spread over and in the leaf debris instead of forming radicating bases.

In studying the species of *Tylostoma* from the Panjab Plains, the senior author was amazed at the following peculiarities in these collections:

1. The preponderance of small or tiny plants which makes the Panjab seem a land of midget *Tylostomas*. There is nothing like it in the United States.
2. The small number of medium size and large species, only 2 or 3.
3. The absence of plants with well-developed fibrillose mouths.
4. The absence of any well-developed volvas on most of the collections.
5. The large number of specimens with radicating bases.
6. The large number of plants that are covered with dried dirt or clay.

Long (1944, 1947) proposed the following subdivisions for the exoperidia and for the mouths of *Tylostoma*. He divided the exoperidium into two distinct zones, a basal band or peridial sheath enclosing the base of the endoperidium, and the remaining portion consisting of the exoperidium proper. This *peridial sheath* is a tough layer of agglutinated hyphae and sand, firmly attached to the base of the endoperidium and usually differing in texture and composition from the exoperidium proper.

The exoperidium proper may occur in one of 4 different types of structure: 1. A granular type consisting of hyphae and sand; 2. A semi-membranous structure; 3. A permanently membranous exoperidium; 4. The hyphal type which may be split off from the granular type when the granular portion is very thin or evanescent and when the hyphal portion consists of an amorphous layer of flocci covering the endoperidium and firmly attached to it. This fourth type is usually covered with brownish warts. Under this hyphal type come the following species: *Tylostoma verrucosum*, *T. dumeticola*, *T. Bonianum*, *T. Leveilleanum*, *T. exasperatum*, *T. mussooriense* and *T. crassipes* (this without any warts).

The mouths may be as follows: tubular, semi-tubular, fibrillose, subfibrillose, indefinite, operculate and valvate. The tubular, fibrillose and indefinite need no description as they are well-established forms, but the others need to be defined. The subfibrillose are those mouths which have very small fibrils and often merge into the indefinite forms, that is, some

heads may show a few fibrils while other heads in the same collection may have naked indefinite mouths. The semi-tubular forms are those mouths with a definite elongated very narrow erect border; the valvate type are those which open in a definite stellate valvate manner, of which *T. exasperatum* is a good example. The operculate mouth consists of a torn aperture, linear or elliptic in shape, folded backward as an irregular lid on one side of the orifice and becoming lacerate and indefinite with age and weathering. This operculate type has, so far, been found only in India.

The following are the species discussed in this article, with photographs and technical descriptions of each:

Species with tubular mouths: *Tylostoma mussooriense*, *T. hygrophilum*, *T. evanescens*, *T. sedimenticola*, *T. xerophilum*, *T. subsquamosum*, *T. amnicola*, *T. balanoides*, *T. pluriosteum*, *T. albocretaceum*, *T. psilophilum*, *T. inonotum*, *T. cineraceum*.

Species with subfibrillose to indefinite mouths: *T. parvissimum*, *T. membranaceum*, *T. puncticulosum*, *T. vulgare*.

Species with valvate mouths: *T. exasperatum*, *T. Wightii*.

Species with operculate mouths: *T. exitum*, *T. operculatum*.

Species with indefinite mouths: *T. crassipes*, *T. albiceps*, *T. perplexum*, *T. volvulatum*; making a total to date of 25 species in India, of which 3 have hyphal exoperidia, 3 membranous, 3 semi-membranous and the balance granular exoperidia.

KEY TO THE SPECIES OF *TYLOSTOMA* IN INDIA

1. Exoperidium hyphal 2
1. Exoperidium membranous 3
1. Exoperidium semi-membranous 4
1. Exoperidium granular 5
   2. Mouth tubular, sporocarp warty, brown.....**1. T. mussooriense**
   2. Mouth valvate, sporocarp warty, spores strongly digitiform, with halo **19. T. exasperatum**
   2. Mouth indefinite, naked, sporocarp not warty ...**22. T. crassipes**
3. Mouth subfibrillose to indefinite 6
3. Mouth tubular, plants small, spores verruculose .....**6. T. xerophilum**
   4. Plants small, mouth tubular, sporocarp persistent, spores echinulate **4. T. sedimenticola**
   4. Plants medium size, mouth tubular, sporocarp deciduous, spores verruculose **8. T. balanoides**
   4. Plants large, volva prominent, mouth indefinite...**25. T. volvulatum**
5. Mouths several, subtubular, spores verruculose.....**2. T. pluriosteum**
5. Mouth tubular, plants small, spores smooth.....**3. T. evanescens**
5. Mouth subtubular, plants medium size, wet habitat....**5. T. hygrophilum**
5. Mouth tubular, plants medium size, spores strongly echinate with a halo **7. T. subsquamosum**
5. Mouth tubular, stem volvate, white, spores smooth.....**11. T. albocretaceum**
5. Mouth tubular, plants medium size, drab, spores smooth **12. T. cineraceum**

5. Mouth tubular, plants small, stems brown, endoperidium avellaneous, spores verruculose to smooth.....**10. T. amnicola**

5. Mouth subfibrillose, plants medium size, endoperidium wood brown, stipe striate to sulcate, spores smooth .....**15. T. vulgare**

5. Mouth subfibrillose, plants very small, endoperidium dingy white, stipe rugose to smooth, spores smooth.....**14. T. puncticulosum**

5. Mouth operculate, plants very small, spores strongly verruculose **20. T. exitum**

5. Mouth operculate, plants small, spores smooth.....**21. T. operculatum**

5. Mouth indefinite, plants medium size, sporocarp white, stipe tilleuil buff, spores verrucose .....**23. T. albiceps**

5. Mouth indefinite, plants small, stipe pecan brown, spores verruculose **24. T. perplexum**

5. Exoperidium granular-hyphal 7

6. Plants small, spores echinulate.....**16. T. parvissimum**

6. Plants medium size, spores smooth.....**17. T. membranaceum**

7. Mouth tubular, plants very small, endoperidium brown, spores echinulate **9. T. psilophilum**

7. Mouth tubular, short, exoperidium brown, persistent, spores verruculose **13. T. inonotum**

7. Mouth valvate, endoperidium papyraceous, brown, spores verrucose **18. T. Wightii**

1. Tylostoma mussooriense P. Henn., Hedwigia **40**: 337. 1901.

FIGURE 1

Sporophore having sporocarp, stipe and bulbous base. *Sporocarp* subglobose, 5–6 mm. high by 6–8 mm. wide, firmly attached to stem apex. *Exoperidium* hyphal, having a thin layer of hyphae, with very small flattened warts, Hays brown to burnt umber, tardily and irregularly deciduous over top of the peridium, leaving a scarred surface. *Peridial sheath* similar to the exoperidium and continuous with it, persistent, covered with small warts same color as exoperidium. *Endoperidium* rough from the adhering fragments of the exoperidium and from the scars left by the shedding of the warts, light ochraceous buff, membranous. *Mouth* small, about 1 mm. wide, slow to open, when unopened with a pointed central umbo. *Collar* inconspicuous about 1½ mm. from stem. *Stipe* very slender, tapering upward to apex, terete, with small more or less appressed scales which are more prominent on upper part of stem, walnut brown, 2–6½ cm. tall by 1½–2 mm. thick at top, by 2–3 mm. thick at base. *Bulb* 5–10 mm. thick, of hyphae and sand. *Volva* none. *Radicating base* none. *Gleba* cinnamon. *Capillitium* hyaline, rarely septate, not swollen at nodes. *Spores* subglobose, 3.8–4.95 μ in diameter. *Epispore* verrucose, no halo.

Habitat: Solitary or in groups in gravelly soil on the eastern slopes of bare rocks.

Distribution: Mussoorie-Garhwal Road, 7000 ft. elevation, July 20, 1940, *S. Ahmad*, 8 plants Herb. Ahmad no. *425*, 2 of these now in Herb. Long, no. *11087*. This species was first collected by William Gollan from Mussoorie, Arnigardh on August 9, 1900. This is the first time that it has

been found again and in the same general locality. It is the only *Tylostoma* occurring at this high altitude with an annual rainfall of 110 inches.

This species is close to *Tylostoma verrucosum* Morgan but after a careful comparison of the type material of the 2 species we have decided that they are not the same.

2. Tylostoma pluriosteum sp. nov.

FIGURE 2

Sporocarpo depresso-globoso, 6–8 mm. alto, 14–16 mm. lato. *Exoperidio* pulverulento, toto secedente in aetate. *Endoperidio* membranaceo, gilvo usque albido. *Oribus* subtubulatis singulis usque pluribus. *Stipite* 5–32 mm. alto, 3–5 mm. crasso. *Sporis* subglobosis, 4–5.5 μ. *Episporio* verruculoso.

Sporophore having sporocarp, stipe and slightly swollen base. *Sporocarp* depressed-globose, 6–8 mm. high by 14–16 mm. wide, firmly attached to stem apex. *Exoperidium* granular, deciduous on some plants to only partially so on others. *Peridial sheath* a broad band of hyphae and sand, 4–5 mm. wide, persistent. *Endoperidium* membranous, pitted on top in some plants, and rough in others from the adhering dirt, light buff to dingy white. *Mouth* subtubular, definite with or without a distinct raised collar-like margin, from one to four or more on each head; young freshly emerged heads often with mouths covered at first with raised distinct pointed umbos which when broken off leave the white throats (Fig. 2a) of the mouths exposed. *Collar* wide, about 2 mm. distant from stem. *Stipe* 5–32 mm. long by 2–5 mm. thick; base bulbous and radicating. *Bulb* 6 mm. thick. *Volva* none. *Gleba* ferruginous. *Capillitium* hyaline, lumen small, walls medium to thin, ends of threads at septa rounded, not swollen. *Spores* globose to subglobose, 4–5.5 μ in diameter. *Epispore* verruculose.

Habitat: Solitary or caespitose in sandy soil.

Distribution: Sheikhupura District, Ladhar, *S. Ahmad*, September 8, 1944, 2 plants in Herb. Ahmad no. *1282* **type.** Gujranwala District, Gakkhar, August 12, 1944, 6 plants in Herb. Ahmad no. *1280*. All the mouths in this last collection were immature when collected, having pointed umbos which later showed as mouths when the points were broken off.

3. Tylostoma evanescens sp. nov.

FIGURE 3

Sporocarpo ovato vel subgloboso, 5–9 mm. alto, 5–12 mm. lato. *Exoperidio* granuloso, haud toto secedente. *Endoperidio* membranaceo, albo aetate cinnamomeo. *Ore* tubulato, integro, prominulo. *Stipite* 0.5–2.7 cm. alto, 1–3 mm. crasso, tenui, brunneo. *Sporis* subglobosis, 3.7–5.2 μ. *Episporio* levi.

Sporophore having sporocarp, stipe and radicating base. *Sporocarp* ovate to subglobose, 5–9 mm. high by 5–12 mm. wide, firmly attached to stem apex. *Exoperidium* granular, persistent or partially deciduous in age. *Peridial sheath* persistent, of hyphae and dirt, 2–4 mm. wide, usually covered with dry clay. *Endoperidium* membranous, white when fresh, becoming cinnamon with age, often pitted, generally mottled due to ad-

hering patches of the exoperidium, this probably depending on the frequency of rainfall after the plants elongate. *Mouth* tubular, strongly projecting. *Collar* inconspicuous, about 1 mm. distant from stem. *Stipe* 0.5–2.7 cm. long by 1–3 mm. thick, slender, weak, often broken near or in the socket, even, rarely with appressed scales or smooth or with adhering grains of sand, usual size 1–1½ cm. long by 1–½ mm. thick, often striate, terete, cinnamon to sayal brown. *Radicating base* prominent, often with roots 4–8 mm. long. *Gleba* ferruginous. *Capillitium* branched, hyaline, 3.2–6.5 μ thick, usually narrow and strongly swollen at septa (Fig. A 1). *Spores* globose to subglobose, subhyaline to dilute yellow, 3.7–5.2 μ in diameter, mean 5.25 μ. *Epispore* thin, smooth.

Habitat: Solitary in open sandy wastes, covered with a scattering scanty growth of perennial grasses, especially *Eleusine flagellifera*, *Dactyloctenium scindicum* and *Cyperus conglomeratus*.

Distribution: Rohtak District, Rohtak, *S. Ahmad*, April 10, 1939, 148 plants Herb. Ahmad, no. *254*, 16 of these are now in Herb. Long no. *10259;* April 25, 1939, 193 plants Herb. Ahmad no. *293*, 13 of these are now in Herb. Long, no. *11144* **type.** Sangla Hill, September 19, 1936, 8 plants in Herb. Long. no. *11154* (no. *28* Herb. Ahmad). Sheikhupura District, Ladhar, July 1938, *S. Ahmad*, 2 plants in Herb. Ahmad no. *318*; August 20, 1942, 56 plants Herb. Ahmad. no. *588*, 6 of these now in Herb. Long no. *11124;* August 6, 1944, 48 plants Herb. Ahmad, no. *1276*, 23 of these now in Herb. Long no. *11133*; July 7, 1945, 42 plants Herb. Ahmad, no. *1345*, 10 of these now in Herb. Long no. *11103*; July 15, 1945, 31 plants Herb. Ahmad no. *1402*, 16 of these now in Herb. Long, no. *11105*. Gujranwala District, Gakkhar, *S. Ahmad*, July 10, 1942, 110 plants in Herb. Ahmad, no. *587*; July 7, 1941, 120 plants in Herb. Ahmad no. *590*. Gurdaspur District, Jaggatpur, *S. Ahmad*, August 1937, 2 plants in Herb. Ahmad no. *389*; September 10, 1941, 12 plants in Herb. Ahmad no. *625*. Delhi Ridge near Delhi, on way to the Imp. Agric. Institute, *S. Ahmad*, July 22, 1943, 8 plants in Herb. Ahmad, no. *1278*. Four miles north of Sahkot, near the village of Sathyali, *S. Ahmad*, September 13, 1945, 60 plants Herb. Ahmad no. *1456*, 12 of these now in Herb. Long no. *11123*. Shahkot, *S. Ahmad*, July 1938, 11 plants in Herb. Ahmad no. *1295*. Sheikhupura District, Ladhar, *S. Ahmad*, August 31, 1945, 22 plants Herb. Ahmad no. *1445*, 7 of these now in Herb. Long, no. *11114*; August 10, 1936, 18 plants Herb. Ahmad no. *314*, 4 of these now in Herb. Long, no. *11118;* September 20, 1941, 34 plants Herb. Ahmad no. *591*, 4 of these now in Herb. Long, no. *11150*; August 1936, 6 plants in Herb. Long (Ahmad no. *591a*), no. *11120*. Ladhar, *S. Ahmad*, August 1940, 8 plants in Herb. Ahmad no. *577*; August, 1939, in Herb. Ahmad 4 plants no. *1292*; August 16, 1945, in Herb. Ahmad 3 plants no. *1406*.

This species appears in large numbers after the first showers of the monsoon in July, or in August if the rains are late. At this time the grasses are merely in the form of small knots without any trace of life and so the fungus, although very small in size, cannot be easily over-

looked. It becomes difficult to find late in the season as the grasses which were once insignificant now overshadow the fungus, even if a diligent search is made; most of the individuals are found with their peridia broken off from the stipes by the subsequent heavy showers.

It is a very common plant in the Panjab Plains, occurring in sandy wastes about the villages, left out when the rest of the land was brought under cultivation and irrigated by canals. As these areas are being rapidly brought under cultivation, this species is becoming scarce day by day. After a few years it is bound to become more or less extinct, at least in the Panjab, hence the name *Tylostoma evanescens* used in this paper.

Ahmad in his first paper (1939) referred it to *Tylostoma occidentale* Lloyd but later collections show some additional features not mentioned therein. This species has been compared by Long with the type material of *T. occidentale* Lloyd and found not to be that species. Dr. Coker suggested that it might be a small form of *T. albicans* White, while Dr. Cunningham says it resembles in its smooth spores and tubular stoma, *Tylostoma Leslei* Van der Bijl from South Africa.

4. Tylostoma sedimenticola sp. nov.

FIGURE 4

Sporocarpo globoso, 6–8 mm. alto, 8–10 mm. lato. *Exoperidio* semi-membranaceo nec toto secedente. *Endoperidio* membranaceo, albicanti. *Ore* tubulato integro, prominente. *Stipite* brevi, 8–20 mm. alto, 1:5–2 mm. crasso, brunneo, non squamuloso, striato. *Sporis* globosis vel ellipticis, 3.3–4.5 μ. *Episporio* tenui, echinulato.

Sporophore having sporocarp, stipe and radicating base. *Sporocarp* globose, 6–8 mm. high by 8–10 mm. wide, firmly attached to the stem apex. *Exoperidium* semi-membranous, more or less deciduous. *Peridial sheath* a sand-hyphae band, 2–3 mm. wide, persistent. *Endoperidium* membranous, dingy white to pinkish buff, smooth or rough from fragments of the exoperidium. *Mouth* tubular, small, strongly projecting. *Collar* inconspicuous, 1–2 mm. from stipe. *Stipe* 8–20 mm. long by 1.5–2 mm. thick, cortex peeling, not scaly, striate, cinnamon. *Radicating base* pronounced. *Gleba* ferruginous. *Capillitium* hyaline sparingly septate, septa swollen, 3.8–6.4 μ thick. *Spores* globose to elliptical 3.3–4.5 μ in diameter, average size 3.8 μ thick, subhyaline. *Epispore* thin, echinulate but echinules not very distinct (Fig. A 5).

Habitat: Solitary in sandy loam (not in leaf debris) near banks of the river Beas. The banks of this river are covered with a thick growth of *Tamarix dioica*, *Saccharum spontaneum* and *S. munja*. The plants grow in the loam under *S. munja* Roxb.

Distribution: Gurdaspur District, Jaggatpur, a small village on the banks of the river Beas, 12 miles from Gurdaspur, August 1937, 22 plants Herb. Ahmad, no. *280*, 7 of these now in Herb. Long, no. *11117* **type;** Ahmad no. *280a*, August 1938, 1 plant in Herb. Long no. *11145*; Sept. 10, 1941, 12 plants Herb. Ahmad, no. *623*.

One feature of the soil under consideration is that it is annually covered

by a thick layer of silt; this particular place is in the submontane region with a large annual amount of rainfall.

Previously described by Ahmad (1939) as *Tylostoma pygmaeum*.

5. Tylostoma hygrophilum sp. nov.

FIGURE 5

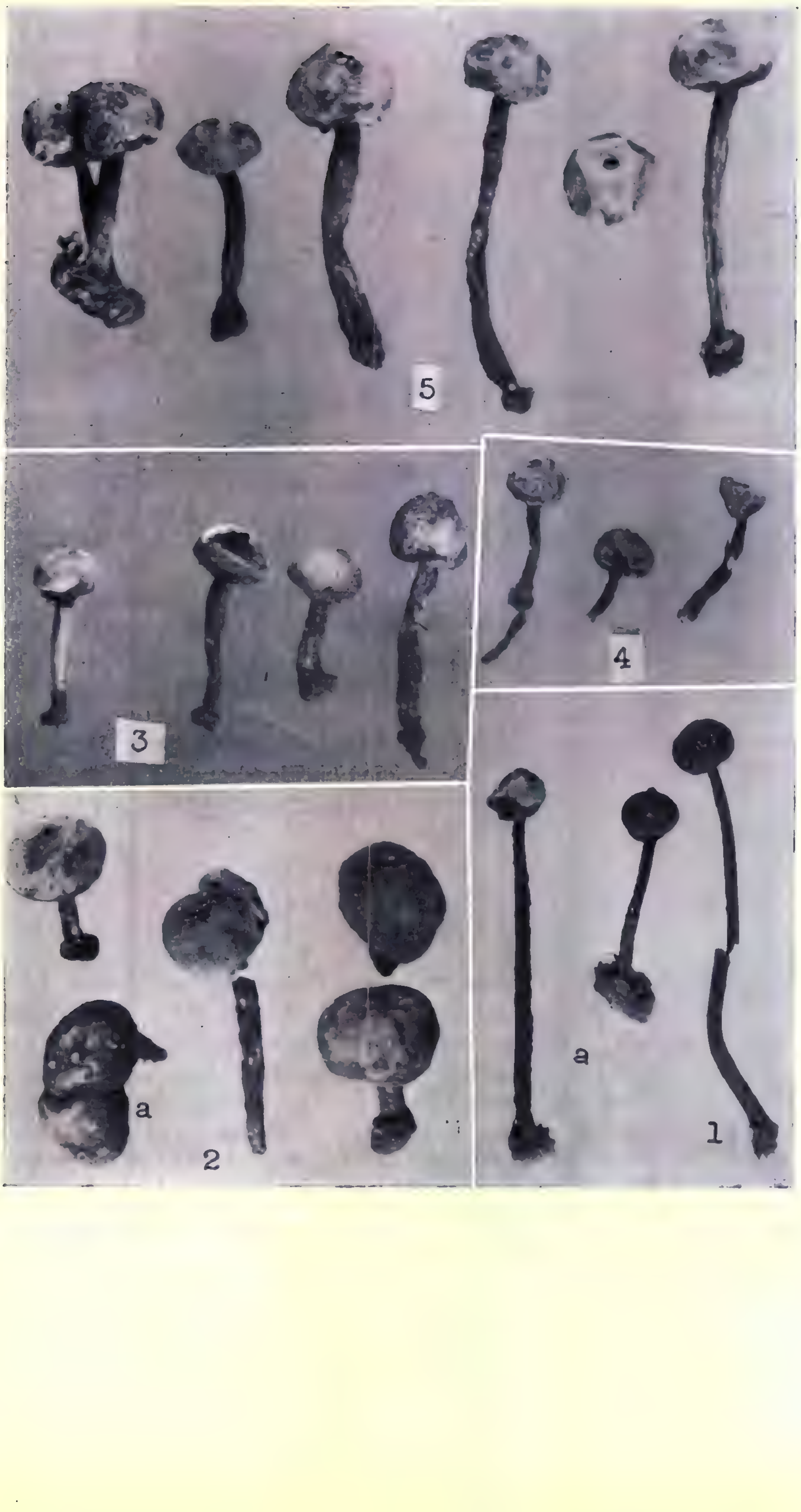
Sporocarpo depresso-globoso, 5–12 mm. alto, 5–19 mm. lato. *Exoperidio* pulverulento, nec toto secedente. *Endoperidio* albido, aetate brunneo, papyraceo. *Stipite* 2–7 cm. alto, 2–5 mm. crasso, albido aetate cinnamomeo. *Ore* subtubulato, brevi. *Sporis* subglobosis vel ellipticis 4.5–5.2 μ. *Episporio* levi.

Sporophore having sporocarp, stipe and slightly bulbous base. *Sporocarp* depressed-globose, often concave beneath, 5–12 mm. high by 5–19 mm. wide, firmly attached to stem apex. *Exoperidium* granular, consisting of hyphae and clay partially washed off by rains in mature plants, finally completely deciduous in age. *Peridial sheath* a layer of hyphae and clay, irregular, 3–5 mm. wide, persistent. *Endoperidium* white to pinkish buff, aging to cinnamon to wood brown, papyraceous, very thin, usually much torn, rough from adhering patches of clay. *Mouth* subtubular, very weak, usually central and circular but often excentric on head, many elliptic, with very slightly raised margins, tube rarely 1 mm. high, 2 plants with 2 mouths each and 1 plant, out of several hundred plants examined, with 3 mouths. *Collar* evident, inside wall vinaceous cinnamon, 3–4 mm. from stem, often pendent around stem and fimbriate. *Stipe* rather stout, rarely straight, usually more or less crooked, sometimes tortuose, 2.4–7.2 cm. high, usual size 3–4 cm. high, 2–5 mm. in diameter, even or slightly tapering upward, strongly striate to sulcate, white when fresh aging to cinnamon, cortex rugose to appressed, scales often peeling. *Bulb* formed of white mycelium and clay. *Gleba* cinnamon. *Capillitium* hyaline, lumen often none, branched, septa very slightly swollen (Fig. A 2). *Spores* globose to subglobose to ellipsoid, subhyaline to ochraceous, 4.5–5.2 μ, mean 4.7 μ in diameter. *Epispore* smooth, thin.

Habitat: Gregarious or usually caespitose in dense clusters, in thick growth of Doob grass (*Cynodon dactylon* — Bermuda grass in U.S.A.), in swampy places and in water-logged areas.

Distribution: Sheikhupura District, Ladhar, *S. Ahmad*, September 22, 1937, 44 plants Herb. Ahmad no. *250*, 4 of these now in Herb. Long no. *10260*; August 4, 1944, 28 plants in Herb. Ahmad, no. *1277*; September 1937, 169 plants Herb. Ahmad no. *1287*, 15 of these now in Herb. Long no. *11104*; August 2, 1945, 45 plants Herb. Ahmad no. *1350*, 19 of these now in Herb. Long. no. *11102*; August 26, 1945, 26 plants Herb. Ahmad no. *1430*, 10 of these now in Herb. Long no. *11131*; September 2, 1945, 130 plants Herb. Ahmad no. *1446*, 12 of these now in Herb. Long no.

Figs. 1–5. *Tylostoma*, × 1: **1,** *T. mussooriense* from **type; 1 a,** *T. mussooriense*, 2 plants from type locality; **2,** *T. pluriosteum*, 6 plants; **2 a,** *T. pluriosteum*, showing white throats where umbos have been broken; **3,** *T. evanescens*, 4 plants; **4,** *T. sedimenticola*, 3 plants; **5,** *T. hygrophilum*, 6 plants.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11119, **type**; August 16, 1945, 13 plants Herb Ahmad no. *1406*; August 1944, 25 plants Herb. Ahmad, no. *1492*. Sargodha, *S. Ahmad*, August 12, 1939, 20 plants in Herb. Ahmad no. *576*. Qila Sattar Shah, Sheikhupura District, *S. Ahmad*, September 29, 1941, 5 plants in Herb. Ahmad no. *624*. Sangla Hill, *S. Ahmad*, (his no. *6*) 24 plants in Univ. N. C. Herb., and 20 plants (Ahmad no. *6*) in Herb. Long. no. *11158*; *S. Ahmad*, 2 plants in Univ. N. C. Herb. (no. *30*. Herb. Ahmad) and 3 plants in Herb. Long, no. *11155*, (Ahmad no. *30*). Bihar Province, Pusa, *E. J. Butler*, July 1906, (his no. *636*) 10 plants, now in Lloyd Myc. Coll. no. *53173*; July 25, 1906, (Butler's no. *640*), 6 plants now in Lloyd Myc. Coll. no. *53172*.

This is one of the commonest species in the Panjab Plains, differing from all others in its mode of growth and habitat. It is nearly always found in waterlogged or low areas where the rain water remains standing for a long time, especially on the margins of cultivated fields under water due to the rise in the level of the subsoil water during the rainy season. The plants occur in dense clusters among the thick Doob grass; the whitish peridia only visible from above. The length of the stems apparently depends on the height of the grass in which it is growing. The basal mycelial threads are white and abundant, binding the clay soil into big balls around the bases of the sporophores. This species is also covered with water completely during the monsoon rains and at this time the spores, loose heads and plants can be carried by the water, thus assisting in distributing the spores. This is quite a contrast to the usual wind-disseminated spores of our common species of *Tylostoma*. This is the only species known to us that normally grows in dense grass or other vegetation; usually when a *Tylostoma* is found on grassy areas in the United States, it grows in open spaces in the grass.

This species was identified by Dr. W. C. Coker as either *Tylostoma albicans* White or *Tylostoma MacAlpinianum* Lloyd and listed by Ahmad (1939) as *Tylostoma MacAlpinianum* and as *Tylostoma albicans* by Cunningham.

6. Tylostoma xerophilum Long, Mycologia **38:** 85–87. 1946.

FIGURE 6

Sporophore having sporocarp and stipe. *Sporocarp* subglobose 4.5–5 mm. high by 6–7 mm. wide, firmly attached to stem apex. *Exoperidium* strongly and permanently membranous, dehiscing in large patches and strips from above downward, outer surface Roods brown, rough from adhering dirt, inner surface pinkish buff, drying to a thin very fragile membrane. *Peridial sheath* a thin irregular band, membranous, 2–3 mm. wide, semi-deciduous. *Endoperidium* pinkish buff, papyraceous, smooth. *Collar* inconspicuous with a lacerate very short margin. *Stipe* 1–2 cm. long, rather stout, 2–3 mm. thick, even, rarely breaking, slightly flattened on one plant, avellaneous. *Volva* none. *Radicating base* none. *Bulb* none. *Gleba* ferruginous. *Capillitium* hyaline, slender, septate, septa

numerous, strongly swollen and rounded at nodes. *Spores* globose, 4.5–6.6 μ in diameter, mean 5.5 μ. *Epispore* walls medium thick, subhyaline to yellowish, verruculose.

Habitat: Solitary or in groups in soil covering rocks.

Distribution: Kirana Hills, near Sargodha, April 1936, *S. Ahmad*, 4 plants Herb. Ahmad, no. *294*. Central Provinces, Umaria, August 1942, *S. M. Sayadain*, 1 plant in Herb. Ahmad no. *589*.

This description was drawn from the Indian material listed above. It differs in some minor details from the original description of this species from Arizona described by Long (1946), but it is too close in all major characters to separate it from this American plant.

7. Tylostoma subsquamosum sp. nov.

FIGURE 7

Sporocarpo globoso usque depresso-globoso, 5–10 mm. alto, 7–11 mm. lato. *Exoperidio* pulverulento, ex parte secedente. *Endoperidio* membranaceo, nec toto levi, brunneo. *Ore* tubulato, brevi. *Stipite* 1–4 cm. alto, 2–3 mm. crasso, subsquamuloso, brunneo usque avellaneo. *Sporis* subglobosis vel ellipticis, 4–5.6 μ. *Episporio* prominenter spinoso, halone alba cincto.

Sporophore having sporocarp stipe and slightly swollen base. *Sporocarp* globose to depressed-globose, 5–10 mm. high by 7–11 mm. wide, firmly attached to stem apex. *Exoperidium* granular-hyphal, partially deciduous on upper half, walnut brown. *Peridial sheath* an irregular band, about 3 mm. wide, similar to exoperidum, persistent. *Endoperidium* membranous, cinnamon to vinaceous cinnamon, mostly covered by the exoperidium. *Mouth* tubular, short, about 1 mm. wide, conspicuous. *Collar* inconspicuous, about 1–2 mm. from stem. *Stipe* 1–4 cm. long by 2–3 mm. thick, with slightly spreading scales, especially near the peridium, peeling off, pecan brown to avellaneous, terete, often curved. *Volva* none. *Radicating base* none. *Gleba* cinnamon. *Capillitium* hyaline, branched, septa rather common, transverse, oblique or with rounded ends, swollen, or only slightly swollen or not at all. *Spores* ellipsoid to globose, 4.1–5.6 μ, mean 4.9 μ. *Epispore* medium thick, strongly echinulate with rather blunt spines, walls brown and spines hyaline to brown, with halo.

Habitat: In sandy soil, not under trees or in leaf debris.

Distribution: Gurdaspur District, Jaggatpur, *S. Ahmad*, August 1938, 4 plants in Herb. Ahmad no. *258* **type**. Dehra Dun, on flower pot, September 11, 1905, *E. J. Butler*, (his no. *646*), 1 plant from Herb. Crypt. Ind. Orient, now in Lloyd Myc. Coll. no. *4488*.

These 2 collections were compared with authentic material of *Tylostoma squamosum* from Hungary determined by Hollós, and from France, determined by Boudier, but there were too many differences. The specimens from India are too small, differing in color and in glebal characters from *T. squamosum*. The 4 plants from Jaggatpur were listed by Ahmad (1939) as *Tylostoma squamosum*.

8. Tylostoma balanoides sp. nov.

FIGURE 8

Sporocarpo oblongo vel subgloboso, 13–15 mm. alto, 11–20 mm. lato, facile ab apice stipitis secedente. *Exoperidio* semi-membranaceo, toto secedente aetate. *Endoperidio* membranaceo, levi, gilvo vel sordide albo. *Ore* tubulato, prominente, integro. *Stipite* 18–35 mm. alto, 3–5 mm. crasso, striato, brunneolo. *Sporis* globosis vel subglobosis, 4.2–4.9 μ. *Episporio* verruculoso.

Sporophore having sporocarp, stipe and radicating base. *Sporocarp* oblong to subglobose, 13–15 mm. high by 11–20 mm. wide, easily separating from stem, usually found on the ground. *Exoperidium* semi-membranous, completely deciduous in age. *Peridial sheath* very prominent, a heavy irregular band of hyphae and soil 2–10 mm. wide, persistent, with the peridium standing in it like an acorn in its cup. *Endoperidium* smooth in age, membranous, cream buff to dingy white. *Mouth* tubular, strongly projecting, margin brittle often breaking off, circular to oval, small about 1 mm. diameter, 1 head having a big central mouth with a small side mouth near the top of the peridial sheath. *Collar* inconspicuous, 2–3 mm. from stem. *Stipe* 18–35 mm. long by 3–5 mm. thick even or slightly tapering upward, brownish, striate and white under the peeling cortex. *Volva* none. *Radicating base* small. *Gleba* cinnamon. *Capillitium* hyaline, unevenly thick, lumen small or none, septa transverse, slightly or not swollen at the nodes (Fig. A 4), branches few, 4–7 μ thick, often flaccid. *Spores* subglobose, uniguttulate, some apiculate, 4–5 μ thick. *Epispore* verruculose.

Habitat: Solitary or gregarious in open, unshaded sandy soil.

Distribution: Rohtak District, Rohtak, *S. Ahmad*, October 10, 1942, 4 plants no. *609* Herb. Ahmad, **type**. Sheikhupura District, Ladhar, *S. Ahmad*, August 25, 1942, 3 plants Herb. Ahmad no. *593*, and 2 plants in Herb. Long no. *11109*, (Ahmad no. *593*).

The outstanding features of this species are its strong resemblance to an acorn in its cup, its deciduous sporocarp and the heavy sandy peridial sheath. The sporocarps when free always fall on their base, with their mouths up, thereby aiding in the dissemination of the spores.

9. Tylostoma psilophilum sp. nov.

FIGURE 9

Sporocarpo depresso-globoso, 4.5–6 mm. alto, 7–18 mm. lato. *Exoperidio* pulverulento, haud toto secedente. *Endoperidio* avellaneo. *Ore* tubulato, prominulo. *Stipite* 4–13 mm. alto, 2–3 mm. crasso, squamuloso, brunneolo. *Sporis* globosis vel subglobosis, 3.8–4.5 μ. *Episporio* luteolo, echinulato.

Sporophore having sporocarp, stipe and bulbous base. *Sporocarp* depressed-globose, 4.5–6 mm. high by 7–18 mm. wide, firmly attached to stem apex. *Exoperidium* hyphal-granular, finally deciduous. *Peridial sheath* a dirt-hyphae irregular band 2–3 mm. wide, semi-deciduous. *Endoperidium* membranous, tough, avellaneous to wood brown. *Mouth* tubular, short, slightly projecting. *Collar* inconspicuous, more or less fimbriate margin, close to stem. *Stipe* 4–12 mm. long by 2–3 mm. thick, straight or

curved with numerous lacerate brown scales, walnut brown. *Base* slightly bulbous. *Volva* none. *Radicating base* none. *Gleba* cinnamon. *Capillitium* hyaline, sparsely septate, little or not swollen at nodes. *Spores* globose to subglobose, 3.7–4.5 μ mean, 4.25 μ. *Epispore* yellowish, sparsely echinulate.

Habitat: In sandy clay soil.

Distribution: Gurdaspur District, Jaggatpur, August 1937, *S. Ahmad*, 9 plants Herb. Ahmad, no. *257*, 4 of these now in Herb. Long, no. *11106*, **type.**

10. Tylostoma amnicola sp. nov.

FIGURE 10

Sporocarpo globoso usque subgloboso, 5–9 mm. alto, 5–10 mm. lato. *Exoperidio* granuloso, toto secedente. *Endoperidio* membranaceo, sublevi, avellaneo. *Ore* tubulato, brevi. *Stipite* 1–2 cm. alto, 1–4 mm. crasso, squamuloso aetate glabrescente, brunneo. *Sporis* ovatis vel subglobosis, 4.2–5.2 μ. *Episporio* verruculoso.

Sporophore having sporocarp, stipe and slightly swollen base. *Sporocarp* globose to subglobose, 5–9 mm. high by 5–10 mm. wide, rather firmly attached to stem apex. *Exoperidium* granular, more or less deciduous. *Peridial sheath* not evident on some plants but pronounced on several loose heads, hyphae and dirt, 1–5 mm. wide, more or less persistent. *Endoperidium* membranous, subsmooth, with fragments of exoperidium and dirt here and there, avellaneous to light cinnamon drab. *Mouth* tubular, short, but evident, small about 1 mm. in diameter. *Collar* definite, 1–2 mm. from stem. *Stipe* 1–2 cm. long by 1–4 mm. thick, terete, even, scaly becoming smooth in age, walnut brown to Roods brown. *Bulb* very small 2–4 mm. thick. *Gleba* Mikado brown. *Capillitium* hyaline, branched, lumen small, septa transverse or ends rounded and then bulbous, usually not or only slightly swollen. *Spores* subglobose to oval, 4.2–5.2 μ in diameter, some apiculate, some uniguttulate. *Epispore* verruculose to smooth.

Habitat: In sandy places on river banks.

Distribution: Bihar Province, Pusa, *E. J. Butler*, no. *641* in Herb. Crypt. Ind. Orient, July 11, 1906, 17 plants in Lloyd Myc. Coll. no *53171*, **type**; 4 plants in Lloyd Myc. Coll. no. *53172a*; no. *637* in Herb. Crypt. Ind. Orient in Lloyd Myc. Coll. no. *53174*. Lahore District on the Ravi River near Lahore, *Dr. Stewart*, May 30, 1867, from Herb. M. O. Cooke, 2 small plants now in Herb. Hort. Kew under name of *Tylostoma Wightii* but certainly not this species. Aligark District (U.P.) from Herb. Forest Research Institute, no. *3885*, Dehra Dun, February 16, 1945, leg. *P. C. Kanjilal*, 10 plants in Herb. Ahmad no. *404*.

11. Tylostoma albocretaceum sp. nov.

FIGURE 11

Sporocarpo subgloboso vel depresso-globoso, 12–14 mm. lato, 8–12 mm. alto. *Exoperidio* pulverulento, toto secedente. *Endoperidio* cretaceo albido, membranaceo. *Ore* tubulato, brevi, elliptico. *Stipite* robusto, 4–4.5 cm. alto, 2–4 mm. crasso, levi, nec squamuloso, albido, volvato. *Sporis* globosis vel ovatis, 4.8–5.2 μ. *Episporio* levi.

Sporophore having sporocarp, stipe, volva and radicating base. *Sporocarp* subglobose to depressed-globose, 8–10 mm. high by 12–14 mm. wide, firmly attached to stem apex. *Exoperidium* a granular dirt coat, partially to completely deciduous. *Peridial sheath* completely deciduous on larger plant and nearly so on the smaller one. *Endoperidium* chalky white, rough from adhering pieces of the exoperidium, membranous. *Mouth* tubular, short, entire, enlarged at base, slightly raised, circular. *Collar* distant from stem, strongly and broadly concave, socket light pinkish cinnamon inside, irregularly fimbriate around edges, about 4 mm. distant from stem apex. *Stipe* white, stout, tapering to base, 4.4–4.5 cm. long by 2–4 mm. thick, smooth, not scaly. *Volva* small, closely clasping the stem, double, having an inner secondary volva consisting of the lacerate fragments of the upper part of the stem cortex. *Radicating* roots, small and short. *Gleba* sepia. *Capillitium* dusky, branched, walls thin to thick, often flaccid, septa not seen. *Spores* globose to subglobose to oval, 4.8–5.2 μ in diameter, contents dusky. *Epispore* smooth, walls dusky.

Habitat: Solitary in clay soil under bushes of *Capparis aphylla*.

Distribution: Rohtak District, Rohtak, October 7, 1945, *S. Ahmad*, 2 plants in Herb. Ahmad no. *1299*, **type.**

This is the only volvate species of *Tylostoma* in India, except *T. volvulatum*, a very unusual circumstance considering the number of species found in the Panjab.

12. Tylostoma cineraceum Long, Lloydia [in press] 1947.

FIGURE 12

Sporophore having sporocarp and stipe, originating 3–5 cm. below the surface of the soil. *Sporocarp* subglobose, small 4–5 mm. high by 7–12 mm. wide, firmly attached to stem apex. *Exoperidium* granular, entirely dehiscent. *Peridial sheath* of dirt and hyphae, irregular, persistent. *Endoperidium* membranous, more or less wrinkled, pale drab gray to drab gray to pale pinkish buff. *Mouth* tubular, tube very short, inconspicuous. *Collar* inconspicuous, close to stem. *Stipe* slender, even, white on upper part where not covered with dirt, 4–8½ cm. tall by 4–5 mm. thick, basal part gone on Indian plant, rough with appressed scurfy scales, slightly striate under scales, straight. *Volva* none. *Radicating base* none. *Gleba* cinnamon. *Capillitium* hyaline, walls medium to thick, 4–9 μ in diameter, septa rare, transverse, not swollen. *Spores* subglobose to oval, uniguttulate, 4–5 μ in diameter. *Epispore* plainly verruculose, walls thin.

Habitat: In soil.

Distribution: **Afghanistan; India.** Baltistan, Skardu Plain, elevation 7250 feet, September 1940, *R. R. Stewart*, 1 plant Herb. Ahmad, no. *622*. (Fig. 12a).

Figs. 6–11. *Tylostoma*, × 1: **6,** *T. xerophilum*, 4 plants; **7,** *T. subsquamosum*, 4 plants; **8,** *T. balanoides*, 4 plants; **9,** *T. psilophilum*, 4 plants; **10,** *T. amnicola*, 7 plants; **11,** *T. albocretaceum*, 2 plants.

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This apparently is the same species collected by Aitchison (his no. *203*) in Afghanistan in Hari-rud Valley, described and figured by Long (1947) under the name *Tylostoma cineraceum*. Afghanistan is quite near Baltistan and has more or less the same type of climate. M. C. Cooke reported (1888) in the records of the Afghan Delimitation Commission, p. 129, 3 collections by Aitchison in the Hari-rud Valley nos. *178*, *181*, *203*, April 7, 11, 1885. Only Aitchison's no. *203* is the above species; the other 2 numbers are something else, and although all 3 collections were called by Cooke *Tulostoma Wightii* Berk., none of them was this species.

13. Tylostoma inonotum sp. nov.

FIGURE 13

Sporocarpo globoso usque depresso-globoso, 5–7 mm. alto, 6.5–10 mm. lato. *Exoperidio* pulverulento, haud toto secedente. *Endoperidio* asperato, roseo-alutaceo. *Ore* tubulato, sat elongato. *Stipite* 8–20 mm. alto, 1.5–2.5 mm. crasso, levi. *Sporis* subglobosis, 4.5–5 μ. *Episporio* verruculoso.

Sporophore having sporocarp, stipe and bulbous base. *Sporocarp* irregularly globose to depressed-globose, 5–7 mm. high by 6.5–10 mm. wide, firmly attached to stem apex. *Exoperidium* hyphal-granular, persistent, pecan brown. *Peridial sheath* of dirt and hyphae, 3–4 mm. wide, persistent. *Endoperidium* rough, due to the adhering exoperidium, pinkish buff. *Mouth* tubular, projecting. *Collar* inconspicuous close to stem. *Stipe* 8–20 mm. long by 1.5–2.5 mm. thick, smooth, very rarely broken into a few irregular scales. *Base* of stipe bulbous; in 2 of the plants stipes and peridia have grown together. *Capillitium* hyaline, branched, septate, 3.2–6.5 μ thick strongly swollen at the nodes which are from 9.6–12.8 μ thick (Fig. A 6). *Spores* globose to subglobose, pale yellowish under the oil immersion lens, 4.5–5 μ in diameter. *Epispore* verruculose.

Habitat: Solitary or gregarious in sandy soil rich in humus, near the base of *Dalbergia sissoo* surrounded by several shrubs.

Distribution: Sheikhupura District, Ladhar, September 15, 1942, 6 plants Herb. Ahmad no. *633*, **type.**

This species has so far been collected only once, but it differs from the other species of the Plains in color of the peridium, verruculose spores, and non-scaly stipe.

14. Tylostoma puncticulosum sp. nov.

FIGURE 14

Sporocarpo subgloboso vel depresso-globoso, 5–8 mm. alto 6–12 mm. lato. *Exoperidio* granuloso, haud toto secedente. *Endoperidio* scrobiculato, albicante, membranaceo. *Ore* subfibrilloso, lacerato, aetate nudo, indefinito. *Stipite* 2–25 mm. alto 1–2 mm. crasso, albicante, aetate cinnamomeo, rugoso vel levi. *Sporis* subglobosis, 4.5–6.6 μ. *Episporio* levi.

Fig. A. Showing capillitium and spores of: **A 1**, *Tylostoma evanescens*; **A 2**, *T. hygrophilum*; **A 3**, *T. puncticulosum*; **A 4**, *T. balanoides*; **A 5**, *T. sedimenticola*; **A 6**, *T. inonotum*. All drawings × 600.

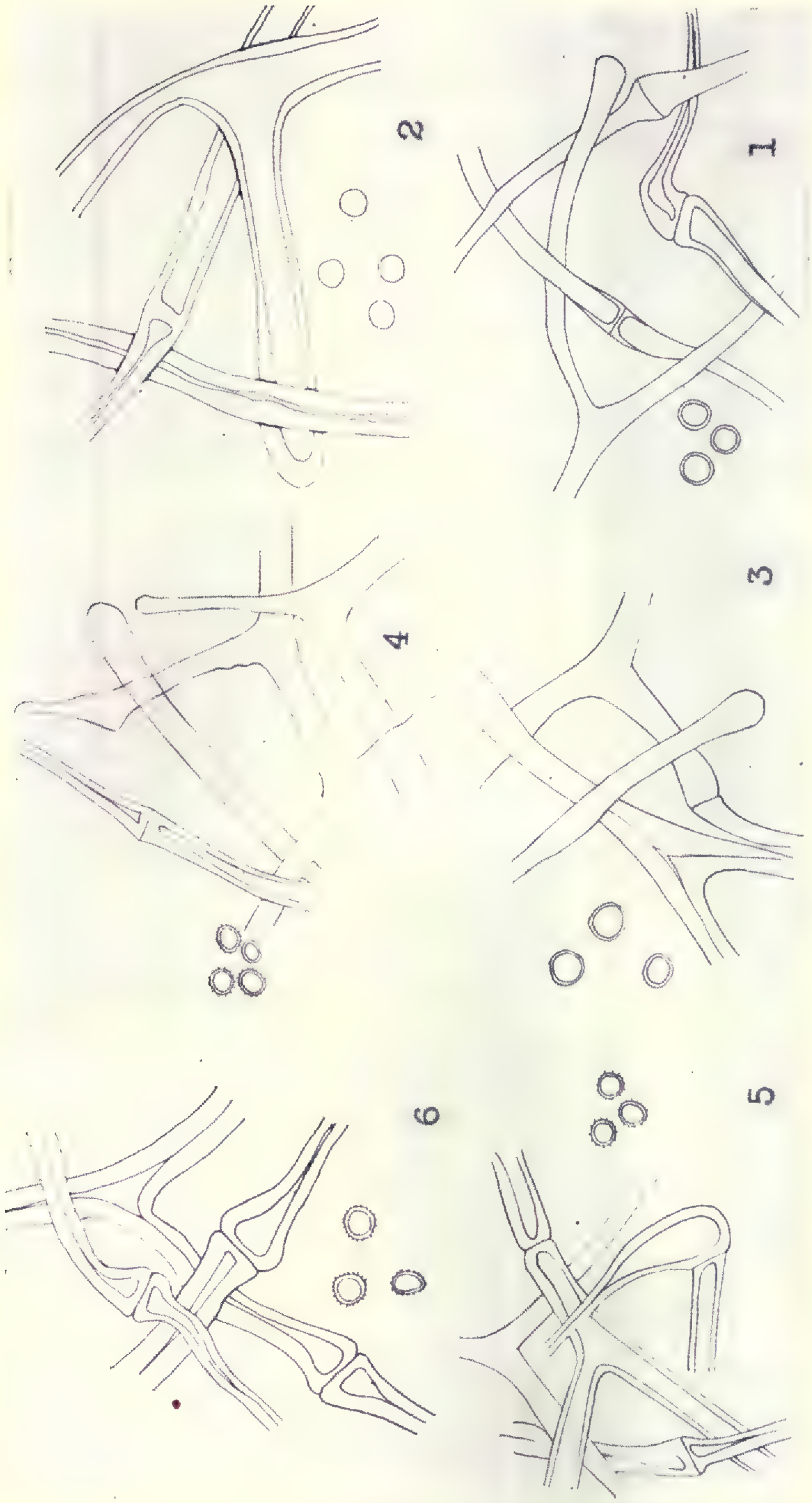


FIGURE A

Sporophore consisting of sporocarp, stipe and slightly bulbous radicating base. *Sporocarp* subglobose to depressed-globose, 5–8 mm. high by 6–12 mm. wide, firmly attached to stem apex. *Exoperidium* granular, long persisting but finally more or less deciduous, then separating with a pitted effect on the endoperidium, when freshly emerged covered with a dense layer of dirt. *Peridial sheath* a layer of sand and hyphae, 2–5 mm. wide, persistent. *Endoperidium* minutely pitted, dingy white to pinkish buff, membranous, tough, often remaining covered by the exoperidium. *Mouth* subfibrillose, fibrils few, granular pitted, losing its scant fibrils and becoming naked, irregular, indefinite and lacerate with age. *Collar* distinct, 1–2 mm. distant from stem. *Stipe* 2–25 mm. long, usual size 15 mm. by 1–2 mm. thick, white when fresh, becoming cinnamon or even darker with age, rugose to nearly smooth, terete, even, not sandy. *Base* slightly enlarged. *Radicating base* with short central root. *Volva* none. *Gleba* ferruginous. *Capillitium* pale yellow to subhyaline 4–5.5 μ thick, branched, somewhat uneven, rarely septate, with slightly swollen nodes (Fig. A 3). *Spores* globose to subglobose, 4.5–6.5 μ in diameter, often apiculate, yellowish. *Epispore* smooth, ochraceous.

Habitat: Solitary in sandy or clayey soil.

Distribution: Sheikhupura District, Sangla Hill, *S. Ahmad*, September 10, 1936, 5 plants in Univ. N. C. Herb. (Ahmad no. *27*) and 3 plants Herb. Long no. *11153* (Ahmad no. *27*); 14 plants in Univ. N. C. Herb. (Ahmad no. *4*) and 7 plants in Herb. Long no. *11152* (Ahmad no. *4*); Ladhar, *S. Ahmad*, September 1936, 36 plants Herb. Ahmad, no. *1288*, 7 of these now in Herb. Long no. *11135;* September 1947, 37 plants Herb. Ahmad no. *300*, 12 of these now in Herb. Long no. *11136*, **type**; April 1938, 40 plants Herb. Ahmad no. *1286*, 10 of these now in Herb. Long no. *11115*. Gurdaspur District, Jaggatpur, *S. Ahmad*, August 19, 1937, 2 plants in Herb. Long no. *11125* (Ahmad no. *303*); August 1938, 7 plants in Herb. Long, no. *11126* and 6 plants no. *11143* (Ahmad nos. *309* and *309a*). Ladhar, September 1937, 3 plants in Herb. Ahmad, no. *310*; September 1939, 71 plants in Herb. Ahmad, no. *311;* August 6, 1944, 20 plants in Herb. Ahmad, no. *312*; September 4, 1944, 7 plants in Herb. Ahmad no. *1281;* August 1944, 9 plants in Herb. Ahmad no. *1293*. Shorkot, August 1938, 23 plants in Herb. Ahmad, no. *621*.

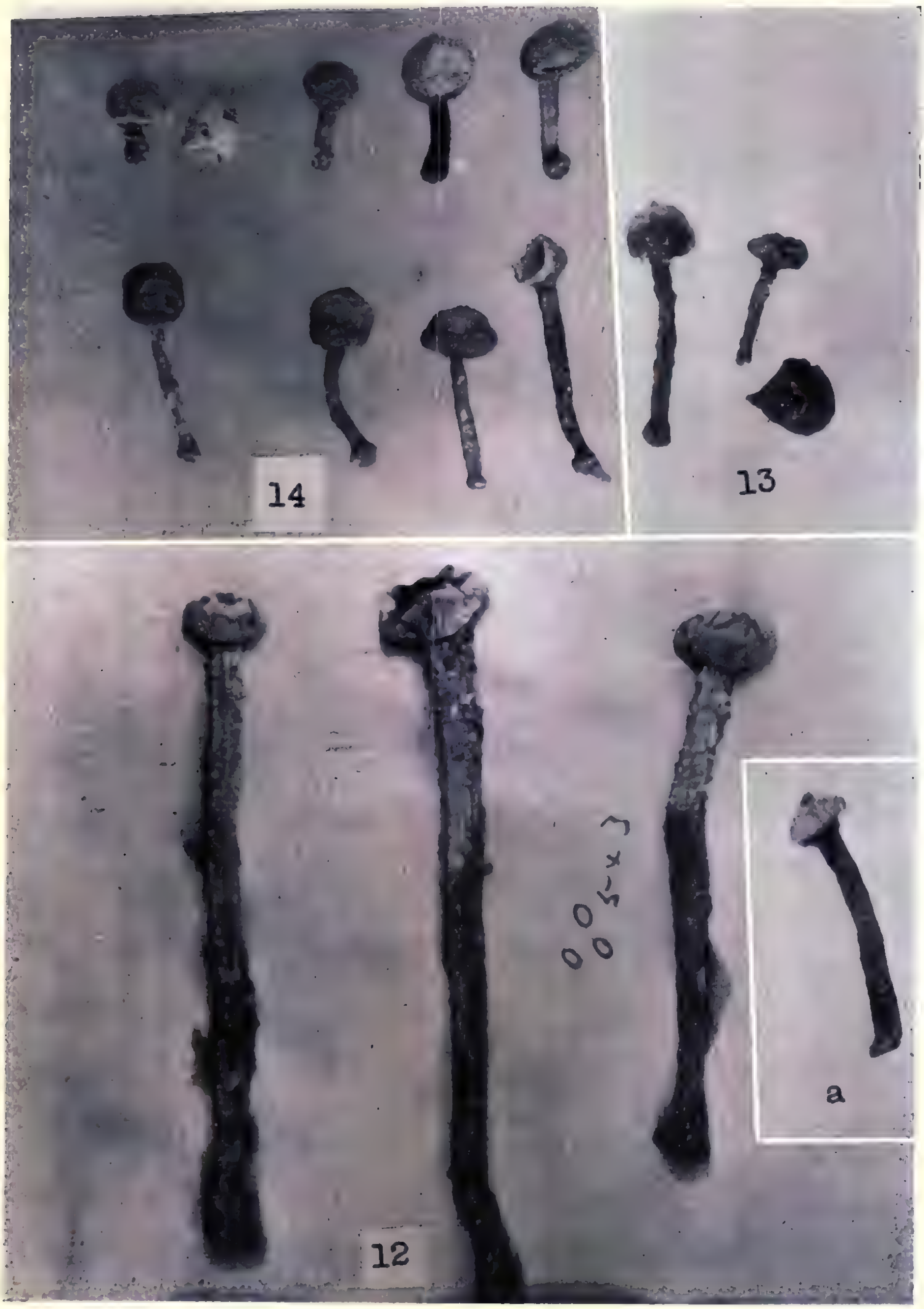
This species was listed by Ahmad (*l.c.*) as *Tylostoma egranulosum* Lloyd.

15. Tylostoma vulgare sp. nov.

FIGURE 15

Sporocarpo subgloboso vel depresso-globoso, 8–12 mm. alto, 10–18 mm. lato. *Exoperidio* granuloso, haud toto secedente. *Endoperidio* membranaceo, avellaneo; asperato. *Ore* subfibrilloso vel indefinito. *Stipite* albicante aetate cinnamomeo, striato vel

Figs. 12–14. *Tylostoma*, × 1: **12,** *T. cineraceum*, 3 plants from Afghanistan, **type; 12 a,** *T. cineraceum*, 1 plant from Skardu, India; **13,** *T. inonotum*, 3 plants; **14,** *T. puncticulosum*, 9 plants.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a

sulcato, 8–40 mm. alto, 3–6 mm. crasso. *Sporis* globosis usque ellipticis, 5.4–6.3 μ. *Episporio* crasso, levi.

Sporophore having sporocarp, stipe and slightly bulbous radicating base. *Sporocarp* subglobose to appressed-globose to pulvinate, 8–12 mm. high by 10–18 mm. wide, firmly attached to stem apex. *Exoperidium* granular, persistent to deciduous. *Peridial sheath* a band of hyphae and sand, 3–5 mm. wide, often inconspicuous, persistent. *Endoperidium* membranous, often pitted around the mouth, avellaneous to wood brown, rough from adhering sand, often entirely covered by the sandy exoperidium. *Mouth* subfibrillose, with very scanty fibrils when fresh, slightly raised, becoming naked and indefinite as the exoperidium is shed, pitted and finally irregularly lacerate in age. *Collar* inconspicuous, 1–2 mm. from stem. *Stipe* dingy white when fresh, then cinnamon on weathering, striate to sulcate, not scaly, even, 8–40 mm. long by 3–6 mm. thick, rarely tapering to base. *Radicating base* with a strong root 5–8 mm. long. *Gleba* ferruginous to sayal brown. *Capillitium* hyaline to yellowish, thick-walled, wavy and irregular, branched, septa rare, little or not swollen. *Spores* globose to ellipsoid, yellowish, 5.4–6.3 μ, mean 5.7 μ. *Epispore* thick, smooth.

Habitat: Solitary in open sandy wastes which are covered with a scanty scattered growth of perennial grasses; appearing before the grass starts into growth from the monsoon rains.

Distribution: Sheikhupura District, Ladhar, *S. Ahmad*, August 1939, 105 plants Herb. Ahmad, no. *291*, 9 of these now in Herb. Long no. *11138*; August 20, 1939, 23 plants in Herb. Long, no. *10257* (from Ahmad no. *291a*); August 10, 1941, 103 plants Herb. Ahmad no. *626*, 3 of these now in Herb. Long, no. *11141;* April 14, 1938, 153 plants Herb. Ahmad no. *1289*, 21 of these now in Herb. Long, no. *11101*, **type**; August 15, 1942, 346 plants Herb. Ahmad, no. *1296*, *22* of these now in Herb. Long, no. *11132*; August 8, 1945, 3 plants in Herb. Ahmad, no. *1428*. Sangla Hill, April 1938, *S. Ahmad*, (Ahmad no. *29*), 4 plants now in Herb. Long no. *11156*. Rohtak District, Rohtak, *S. Ahmad*, January 18, 1943, 70 plants Herb. Ahmad no. *680*, 10 of these now in Herb. Long no. *11139*. Ladhar, August 6, 1944, 4 plants in Herb. Ahmad no. *1284*; August 21, 1938, 6 plants in Herb. Ahmad no. *1291*; September 1941, 4 plants in Herb. Ahmad no. *1294*. Sangla Hill, August 1934, 3 plants in Herb. Ahmad, no. *1290*.

This is one of the commonest species of the Panjab Plains, Ahmad (1939) listed it as *Tylostoma australianum* Lloyd, so determined by Dr. W. C. Coker, but it is not this species, as a careful comparison with type material showed.

16. Tylostoma parvissimum Long & Ahmad, Mycologia **38:** 87–88. 1946.

FIGURE 16

Sporophore consisting of sporocarp, stipe and bulbous radicating base. *Sporocarp* ovate, subglobose to depressed-globose, 3–8 mm. high by 5–10 mm. wide firmly attached to stem apex. *Exoperidium* membranous, outer

surface when freshly emerged covered with a thin adnate layer of dry clay, white under clay, slowly deciduous in flakes, leaving lacerate shreds of the dried membrane on spore sac, completely deciduous in age. *Peridial sheath* a band of agglutinated hyphae and clay, 2–3 mm. broad often forming a cup-like membrane, persistent. *Endoperidium* membranous, white, smooth, sometimes pitted, tough. *Mouth* indefinite, often subfibrillose with a few scant fibrils, slightly raised, in old specimens the fibrils are lost and an irregular naked orifice is left. *Collar* 1–2 mm. long, conspicuous, closely clasping the stem, usually covered with dry clay. *Stipe* slender 2–27 mm. long by 1–3 mm. thick, even, white to wood brown, usually smooth to faintly longitudinally striate, rarely with a few appressed scales. *Radicating base* with one stout root, 4–10 mm. long. *Bulb* small 6–8 mm. thick, firm. *Volva* none. *Gleba* clay color to raw sienna. *Capillitium* hyaline, much branched, side branches smaller, 2–6 mm. thick, lumen scant or none, flexuous, ends of threads square, septa rare not swollen. *Spores* globose to broadly oval, uniguttulate in water mount, 4.2–5.4 μ. *Epispore* hyaline to slightly fulvous, about 1 μ thick, appearing granular in water mount, but distinctly and moderately echinulate in chloral hydrate and also in benzoazurin mount.

Habitat: Solitary in clayey soils, common on such areas, in semi-deserts.

Distribution: Rohtak District, Rohtak, *S. Ahmad*, June 15, 1941, **type**, 10 plants in Herb. Long no. *10621*, (Herb. Ahmad no. *338*); July 1941, 6 plants in Herb. Long, no. *11026*, (Herb. Ahmad *338a*) and 11 plants in Herb. Long *11121*, (Herb. Ahmad *338b*); *S. Ahmad*, June 8, 1941, 99 plants Herb. Ahmad *339*, 17 of these now in Herb. Long no. *11127*; October 1941, 45 plants Herb. Ahmad no. *636*, of these 10 now in Herb. Long no. *11129*.

17. Tylostoma membranaceum sp. nov.

FIGURE 17

Sporocarpo globoso usque depresso-globoso, 8–16 mm. alto, 10–22 mm. lato. *Exoperidio* membranaceo, albicante. *Ore* subfibrilloso vel nudo. *Stipite* 1.7–4 cm. alto, 3–6 mm. crasso, brunneo, squamuloso. *Sporis* subglobosis, 4.5–5.5 μ. *Episporio* levi.

Sporophore having sporocarp, stipe and bulbous radicating base. *Sporocarp* globose to depressed-globose, 8–16 mm. high by 10–22 mm. wide, firmly attached to stem apex. *Peridial sheath* covered with dry clay therefore not seen. *Exoperidium* membranous, covered with dried clay, deciduous in age. *Endoperidium* membranous, white to pinkish buff. *Mouth* subfibrillose surrounded by a zone of fibrils which is lost in age, fibrils scanty or even undeveloped in some specimens, small. *Collar* inconspicuous, 1–2 mm. from stem apex. *Stipe* even, terete, 1.7–4 cm. long by 3–6 mm. thick, pecan brown to walnut brown, scaly, with small ascending scales. *Base* bulbous, 6–10 mm. in diameter of hyphae and clay. *Radicating base* present or none. *Gleba* ferruginous. *Capillitium* hyaline. *Spores* globose to subglobose, 4.5–5.5 μ in diameter. *Epispore* smooth.

Habitat: Gregarious among grass in clay soil.

Distribution: Rohtak District, Rohtak, *S. Ahmad*, September 26, 1945, 8 plants Herb. Ahmad no. *1475*, **type**, 3 of these now in Herb. Long no. *11507*. It differs from *Tylostoma parvissimum* in the larger size and more definite fibrillose mouth, brownish scaly stipe and smooth spores. It resembles that species in the membranous exoperidia and the whitish endoperidium. A comparison side by side of this collection with plants of *T. parvissimum* show the 2 are not the same species.

18. Tylostoma Wightii Berk., London Jour. Bot. **1:** 157. 1842.

FIGURE 18

Sporophore having sporocarp, stipe and slightly enlarged base. *Sporocarp* subglobose, 14 mm. high, 18 mm. wide, firmly attached to stem apex. *Exoperidium* of the granular-hyphal type, deciduous on upper part, hyphal layer on lower half persistent, free of dirt, pecan brown to army brown, with a more or less stellate margin. *Peridial sheath* merged with the exoperidium, persistent. *Endoperidium* papyraceus, thin, tilleuil buff, flaccid, wrinkled. *Mouth* flat, fringed-appendage or valvate, obscure on specimen, partially hidden by being pasted on card, fimbriate-lacerate, not tubular, not definite. *Collar* not evident, hidden by being flattened when pasted on card. *Stipe* 2½ cm. long by 3 mm. wide, slightly scaly with appressed peeling scales, slightly curved. *Base* slightly enlarged by ball of dirt and hyphae. *Gleba* hazel. *Capillitium* hyaline, much branched, 4–5 μ thick, ends rounded, some threads flaccid, septa very rare, not swollen, ends of septa transverse, irregularly thickened. *Spores* subglobose, 4.2–5.4 μ diameter. *Epispore* verruculose.

Habitat: Solitary in soil.

Distribution: Near Madras, 1867, 1 plant type in Herb. Hort. Kew, England.

19. Tylostoma exasperatum Mont., Ann. Sci. Nat. (Bot.) II, **8:** 362. 1837.
Tylostoma Ridleyi Massee, Kew Bull. Misc. Inform. **1899:** 173. 1899.

FIGURE 19

Sporophore having sporocarp, stipe and caespitose base. *Sporocarp* subglobose, 10–12 mm. high by 11–18 mm. wide including the long warts. *Exoperidium* a hyphal layer covered by long pointed, conical warts, warts 1–3 mm. long, burnt umber, deciduous on upper part leaving distinct whitish-brown scars. *Peridial sheath* a continuation of the exoperidium, but warts shorter, persistent. *Endoperidium* pecan brown, context soft, surface rough from scars left by the shed warts. *Mouth* valvate, of 4–5 valves, walnut brown or slightly darker. *Collar* inevident, hidden by flattened head. *Stipe* even, scaly, scales flattened and easily shedding, 2–5 cm. long by 3.4 mm. thick, caespitose, burnt umber. *Volva* none. *Radicating base* none. *Gleba* cinnamon. *Capillitium* hyaline to tinted, walls thin,

Figs. 15–17. *Tylostoma*, × 1: **15,** *T. vulgare*, 10 plants; **16,** *T. parvissimum*, 9 plants; **17,** *T. membranaceum*, 3 plants.

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lumen large, small threads hyaline, branched, septa transverse, not swollen. *Spores* globose, with strong halo. 5–5.6 μ exclusive of halo, 6–7 μ including halo. *Epispore* with very prominent halo, spines brown.

Habitat: Apparently on rotting wood in this case.

Distribution: Nilgiris, *Capt. Badham*, 1867, 9 plants from Herbarium Berkeleyeanum now in Herb. Hort. Kew, England.

The above description was made from this Indian collection. This is a very marked species and widely distributed over the world in tropical and subtropical regions according to Long (1947) and other writers.

20. Tylostoma exitum sp. nov.

FIGURE 20

Sporocarpo ovato usque subgloboso, 4–8 mm. alto, 5–11 mm. lato. *Exoperidio* granuloso, haud toto secedente. *Endoperidio* membranaceo, albicante, duro. *Ore* operculato, aetate indefinito, nudo. *Stipite* brevi, 0.5–15 mm. alto, 1–3 mm. crasso, superne squamoso, deorsum denudato, brunneo. *Sporis* subglobosis, 3.7–5.5 μ. *Episporio* luteo, verruculoso.

Sporocarp ovate to subglobose, 4–8 mm. high by 5–11 mm. wide, firmly attached to stem apex. *Exoperidium* granular, more or less adherent, rarely deciduous. *Peridial sheath* a narrow band of sand and hyphae, 2–4 mm. wide, persistent. *Endoperidium* tough, membranous, dingy white to pinkish buff. *Mouth* operculate, a torn aperture, linear or elliptic in form with the torn margin or lid folded backward on one side of the aperture becoming lacerate and indefinite with age, $\frac{1}{2}$–1 mm. diameter. *Collar* inconspicuous about 1 mm. from stem. *Stipe* short, 0.5–15 mm. long by 1–2 mm. thick, even, slightly scaly, covered with lacerate membranous scales for some distance below peridium, cinnamon to pecan brown, smooth, some striate. *Base* slightly bulbous. *Gleba* cinnamon. *Capillitium* hyaline, branched, septa transverse or oblique, thick-walled, mostly about 5 μ thick but some up to 8 μ, septa slightly to strongly swollen. *Spores* globose to subglobose, 4.8–5.5 μ in diameter. *Epispore* pale yellow, distinctly verruculose.

Habitat: In sandy soil on the sides of a water course, not found anywhere else except at one particular spot, and as the water course is cleaned of silt frequently, so it has disappeared and has not been collected for the last 8 years.

Distribution: Sheikhupura District, Ladhar, August 1936, 12 plants Herb. Ahmad no. *1279*; September 1937, 10 plants Herb. Ahmad no. *296*, and 7 plants in Herb. Long no. *11157*, **type**, (no. *26* Herb. Ahmad) from Sangla Hill; August 25, 1938, 15 plants in Herb. Ahmad no. *471*. This plant was originally listed by Ahmad as *T. adhaerens* following Dr. W. C. Coker's tentative identification as a small form of this species. It

Figs. 18–19. *Tylostoma*: **18,** *T. Wightii*, 1 plant, **type,** from Herb. Hort. Kew, × 1; **19,** *T. exasperatum*, 6 plants from Nilgiris, India, × 1; **19 a,** *T. exasperatum*, showing the valvate mouth, × 2.

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has been compared with authentic material of the true *T. adhaerens* and found to be an entirely different species.

21. Tylostoma operculatum sp. nov.

FIGURE 21

Sporocarpo depresso-globoso, 4–10 mm. alto, 5–14 mm. lato. *Exoperidio* granuloso, haud toto secedente. *Endoperidio* membranaceo, crasso, cinnamomeo. *Ore* operculato, aetate indefinito. *Stipite* 8–15 mm. alto, 3–5 mm. crasso, levi, striato. *Sporis* globosis vel subglobosis luteis, 4.2–5.2 μ. *Episporio* fulvo, levi.

Sporophore having sporocarp, stipe and bulbous radicating base. *Sporocarp* depressed-globose, 4–10 mm. high by 5–14 mm. wide. *Exoperidium* granular, firmly attached to stem apex, semi-deciduous. *Peridial sheath* a layer of hyphae and dirt, 3–4 mm. wide. *Endoperidium* thick, tough, cinnamon, long covered by the exoperidium, membranous. *Mouth* operculate, a definite orifice formed by the tearing apart of the apical portion, which persists on the margin as an irregular lid but becomes more or less indefinite in age under weathering; this operculate mouth is very pronounced on fresh specimens. *Collar* conspicuous 2–3 mm. distant from stem, with a lacerate margin. *Stipe* rather stout, 6–14 mm. long by 3–5 mm. thick, often striate, even or dilated either toward base or toward apex, avellaneous. *Base* bulbous and radicating. *Gleba* cinnamon. *Capillitium* hyaline, branched, sparsely septate, slightly swollen at the nodes. *Spores* globose to subglobose, pale yellowish, uniguttulate, 4.5–5.2 μ. *Epispore* fulvous, smooth.

Habitat: On ground in rich clay.

Distribution: Gurdaspur District, Jaggatpur, August 1938, *S. Ahmad*, 32 plants Herb. Ahmad no. *308*, **type**, 5 of these now in Herb. Long no. *11116;* August 20, 1938, 2 plants in Herb. Ahmad *308a*, now in Herb. Long, no. *11146*. Sargodha, *S. Ahmad*, July 1940, 2 plants in Herb. Ahmad no. *398*.

22. Tylostoma crassipes sp. nov.

FIGURE 22

Sporocarpo subgloboso usque depresso-globoso, 3–8 mm. alto, 5–12 mm. lato. *Exoperidio* hyphali, nec verrucoso, avellaneo, tarde deciduo. *Endoperidio* membranaceo, albicante. *Ore* indefinito, nudo. *Stipite obeso*, 2–20 mm. alto, 3–6 mm. crasso, rugoso, parum striato. *Sporis* subglobosis usque pyriformibus, 4.2–5.6 μ. *Episporio* levi.

Sporophore having sporocarp, stipe and radicating base. *Sporocarp* subglobose to depressed-globose, 3–8 mm. high by 5–12 mm. wide, firmly attached to stem apex. *Exoperidium* hyphal, inner layer of hyphae continuous, very thin, long persistent, not verrucose, very slowly deciduous, avellaneous, similar to *T. verrucosum* but not warted. *Peridial sheath* an extension of the exoperidium, very inconspicuous, persistent. *Endoperidium* white to pinkish buff, membranous, long covered by the exoperidium. *Mouth* indefinite, naked, irregularly orbicular, enlarging with age, small from 0.5 mm. when young to $1\frac{1}{2}$ mm. in age. *Collar* definite, descending

around top of stem slightly, with laciniate edges close to stem. *Stipe* stout, short, 2–20 mm. long by 3–6 mm. thick, even, rugose, sometimes striate, with adhering dirt, scales none, pinkish buff under the dirt. *Volva* none. *Radicating base* with roots 3–5 mm. long, slender. *Gleba* ferruginous. *Capillitium* hyaline, flaccid, 4–5 μ thick, branched, septa not seen. *Spores* subglobose, oval to pear shaped, 4.2–5.6 μ in diameter, sub-hyaline. *Epispore* smooth.

Habitat: In sandy to clayey soil.

Distribution: Gujranwala District, Gakkhar, *S. Ahmad*, August 1942, 185 plants Herb. Ahmad no. *634*, 25 of these now in Herb. Long no. *11137* **type**; August 15, 1941, 163 plants Herb. Ahmad no. *512*, 23 of these now in Herb. Long no. *11142*. Shahkot, *S. Ahmad*, July 18, 1939, 9 plants in Herb. Ahmad no. *623*. This species is characterized by its relatively stout stem, hyphal exoperidium and indefinite mouth.

23. Tylostoma albiceps sp. nov.

FIGURE 23

Sporocarpo subgloboso, 6–10 mm. alto, 10–15 mm. lato. *Exoperidio* granuloso, haud toto secedente. *Endoperidio* albo. *Ore* indefinito. *Stipite* crasso, 3–3.5 cm. alto, 4–5 mm. crasso, levi. *Sporis* subglobosis vel ovatis, 4–5 μ diameter. *Episporio* verrucoso.

Sporophore having sporocarp, stipe and bulbous radicating base. *Sporocarp* subglobose, 6–10 mm. tall by 10–15 mm. wide, firmly attached to stem apex. *Exoperidium* granular, semi-deciduous. *Peridial sheath* of sand and hyphae, 4–5 mm. wide, persistent. *Endoperidium* white, rough with fragments of exoperidium and dirt, membranous. *Mouth* indefinite, small, circular, not raised. *Collar* inconspicuous, more or less clasping the stem. *Stipe* stout, straight, 3–3$\frac{1}{2}$ cm. long by 4–5 mm. thick, even, tilleuil buff, not scaly, cortex sometimes shedding. *Base* slightly bulbous and radicating. *Volva* none. *Gleba* cinnamon. *Capillitium* hyaline, branched, lumen small, threads 6–7 μ thick, no septa seen. *Spores* subglobose to oval, 4–5 μ in diameter, with a slight halo. *Epispore* verrucose, walls dark brown.

Habitat: Solitary in sandy soil.

Distribution: Rohtak District, Rohtak, *S. Ahmad*, June 1941, 2 plants Herb. Ahmad, no. *1293*, **type**.

24. Tylostoma perplexum sp. nov.

FIGURE 24

Sporocarpo subgloboso, 3–5 mm. alto, 5–10 mm. lato. *Exoperidio* pulverulento, nec toto secedente. *Endoperidio* membranaceo, albicante. *Ore* indefinito. *Stipite* 3–35 mm. alto, 2–3 mm. crasso, levi, brunneo. *Sporis* subglobosis usque ovatis, 4.2–5 μ. *Episporio* verruculoso.

Sporophore having sporocarp and stipe. *Exoperidium* granular, slowly deciduous on some plants and covering the heads of many. *Peridial sheath* granular, 2–3 mm. broad, persistent. *Endoperidium* pinkish buff, rough from fragments of the exoperidium and dirt. *Mouth* indefinite, irregularly

lacerate, circular to oval. *Collar* free or clasping the stem, slightly lacerate, more or less pendent around the stem. *Stipe* 3–35 mm. long by 2–3 mm. thick, smooth (not scaly), more or less striate, pecan brown. *Base* not radicating, slightly enlarged. *Volva* none. *Gleba* cinnamon. *Capillitium* hyaline, branched, 5–6 μ thick, septa transverse, not swollen, lumen small. *Spores* subglobose to oval, 4.2–5 μ in diam. *Epispore* verruculose.

Habitat: In sandy wastes.

Distribution: Sheikhupura District, Ladhar, *S. Ahmad*, August 1938, 33 plants Herb. Ahmad no. *295*, 7 of these now in Herb. Long no. *11149*, **type**.

Stipes on many plants long in comparison with the size of heads.

25. Tylostoma volvulatum Borszczow, Zapiski Imp. Acad. Nauk St. Petersbourg **7**: 189. 1865.

Tylostoma Boissieri Kalchb. Rev. Mycol. **3**: 24. *pl. 15, fig. 2.* 1881.
Tylostoma Barbeyanum Henn. Bull. Herb. Boissier **1**: 99. 1893.

FIGURE 25

Sporophore having sporocarp, stipe, volva and radicating base. *Sporocarp* subglobose to depressed-globose, 7–26 mm. high by 12–52 mm. wide, prominently concave at insertion of stipe, firmly attached to stem apex. *Exoperidium* semi-membranous, 1 mm. thick, deciduous, (Fig. 25c) often leaving some sand on the endoperidium, which finally falls off, thus becoming completely deciduous. *Peridial sheath* usually completely deciduous. *Endoperidium* white when young soon becoming light buff to cinnamon, membranous, tough, often with large circular wart-like excrescences which sometimes fall out leaving holes through to the gleba, minutely asperate or becoming smooth in age, minutely pitted around mouth in some plants. *Mouth* solitary, indefinite, central, naked, circular rarely with slightly raised edges from extrusion of gleba, which are friable and crumbling to enlarge the stoma to an irregular circular or oval orifice, rarely truly lacerate; only one true mouth, but a few plants may have 2–5 openings produced by wart-like excrescences on the endoperidium, dropping out, leaving holes simulating true stomata (Fig. 25b), 0–6 mm. in size, usually 2–4 mm. rarely splitting under extreme weathering. *Collar* from inconspicuous to prominent, margin on some irregularly fimbriate from fragments of stem cortex, rarely the upper part of volva adheres to the collar (Fig. 25d), socket usually large and strongly concave, rarely flat. *Stipe* even to attenuate downward, 1–15 cm. long by 4–18 mm. thick, apex dilated, usually straight, rarely curved or tortuose (Fig. 25a), smooth when first emerged, the outer cortical layer caducous, often in large flakes or scales, thereby exposing the next layer which is white when fresh but soon becomes pinkish buff to cinnamon, hard, striate to strongly sulcate, woody, walls thick, lumen small having a prominent white myce-

Figs. 20–24. *Tylostoma*, × 1: **20,** *T. exitum*, 7 plants; **21,** *T. operculatum*, 7 plants; **22,** *T. crassipes*, 6 plants; **23,** *T. albiceps*, 2 plants; **24,** *T. perplexum*, 4 plants.

23

24

22

20

21

lial strand. *Volva* very large, firm, cup-shaped, 10–25 mm. wide by 8–10 mm. high, covered with sand, persistent, context dingy white, base of stem inside volva slightly enlarged. *Base* radicating, roots central, stout, 6–12 mm. thick, several cm. long, usually only 4–10 mm. long in herbarium specimens. *Gleba* Kaiser brown to hazel. *Capillitium* colored, branched, septa very rare, slightly swollen. *Spores* globose to ellipsoid, 3.7–5.2 μ in diameter. *Epispore* hyaline to slightly yellowish, medium thick, smooth.

Habitat: Solitary, usually in deep sand.

Distribution: Sheikhupura District, Sangla Hill, *S. Ahmad*, September 1936, 7 plants in Herb. Univ. N. C. (Ahmad no. *3*); August 19, 1937, 4 plants in Herb. Univ. N. C. (Ahmad no. *22*). Sargodha District, Sargodha, April 1937, 11 plants in Herb. Ahmad no. *302* and 2 plants in Herb. Univ. N. C. (Ahmad no. *31*); August 1938, *22* plants Herb. Ahmad no. *233*, 4 of these now in Herb. Long no. *11151*. Rohtak District, Rohtak, June 1939, 15 plants in Herb. Ahmad, no. *240*; June 1939, 81 plants Herb. Ahmad, no. *301*, 48 of these now in Herb. Long no. *11138*; May 25, 1940, 6 plants in Herb. Long no. *10258*; June 25, 1939, 30 plants in Herb. Long no. *11112*; July 1939, 12 plants in Herb. Ahmad no. *311* (abnormally long stipes were found on 6 of these plants, measuring up to 18 cm. while the peridia were comparatively smaller, 1.4–2.6 cm.). 4 plants in Herb. Long no. *11150* (Ahmad no. *311*); August 1939, 118 plants Herb. Ahmad no. *313*, 33 of these now in Herb. Long, no. *11137*; June 10, 1940, 60 plants in Herb. Ahmad no. *340*; 140 plants in Herb. Ahmad no. *341*; 4 plants in Herb. Ahmad no. *485* (in one plant the stipe is 2 cm. thick); June 1942, 2 plants in Herb. Ahmad no. *491* (the apex of the stipe on 1 plant is flattened exactly as in *Chlamydopus* and this feature is also found in some other plants but not so pronounced); July 1939, 2 plants in Herb. Long no. *11111* (Ahmad no. *1487*); June 1940, 33 plants in Herb. Long no. *11113* (Ahmad no. *1488*); October 15, 1945, 3 plants in Herb. Ahmad no. *1491*. Sheikhupura District, Ladhar, April 8, 1938, 8 plants in Herb. Ahmad, no. *574*; September 7, 1945, 6 plants in Herb. Ahmad no. *1450*; 4 miles north of Shahkot, September 13, 1941, 3 plants in Herb. Ahmad no. *1457*. Bahawalpur State, Pallah, July 16, 1944, 9 plants in Herb. Ahmad, no. *1285*.

One specimen in Ahmad collection no. *301* measured as follows: peridium 3.4 cm. in diameter, 2 cm. high, mouth a torn aperture 8 mm. wide, stipe 14 cm. long, 1.3 cm. thick at apex and 8 mm. thick at base, volva 2.2 cm. in diameter. Ahmad collection no. *302* had many small plants, some only 1.3 cm. in diameter by 6 mm. high and stipe 26 mm. long by 9 mm. thick; this was due to long dry periods in which the plants did not reach their normal sizes.

Fig. 25. *Tylostoma*, × 1: **25**, *T. volvulatum*; **25 a**, Shows plant with twisted stem; **25 b**, Shows plant with several mouths; **25 c**, Shows plant with piece of exoperidium still attached to endoperidium; **25 d**, Shows remains of volva attached to base of peridium around top of stipe. Specimen from Africa.

a
b
c
d
25

Many specimens of *Tylostoma volvulatum* have been deposited in the Herb. Crypt. Ind. Orient at New Delhi, India.

There are several species of *Tylostoma* given by various writers as synonyms of *T. volvulatum*. Hollós lists the following: *T. Boissieri* Kalch., *T. kansense* Peck, *T. meyenianum* Morgan, *T. Jourdani* Pat., *T. obesum* C. & E., *T. gracile* White, *T. tortuosum* Ehrenb., *T. Schweinfurthii* Bres. and *T. Barbeyanum* Henn. Some of these are certainly not synonyms. *T. obesum* belongs to an entirely different section, those with fibrillose mouths; *T. gracile* is not a *Tylostoma* but is a small specimen of *Chlamydopus meyenianus* according to Long (1946). *T. Schweinfurthii* is *Schizotoma laceratum*. Long has examined authentic material of *T. Jourdani* collected by Schweinfurth in Africa from the Herbarium of Patouillard, also the type of *T. kansense* and found that these two species are not *T. volvulatum*; how accurate the other determinations of Hollós are we do not know.

We have been unable to locate the type or authentic specimens of *Tylostoma volvulatum* for examination, but from descriptions and figures of this species we are following Sorokin's (1890) and Patouillard's conception of this species. We have seen specimens identified by Patouillard as *T. volvulatum* and they agree in detail with our plants hence we are calling our fungus *Tylostoma volvulatum*, although they do not agree in every way with the original description given by Borszczow (1865) for the species. Many of these earlier descriptions do not give the salient features by which one can identify the species, in fact it is usually impossible to be certain just what plant the author described without examining, side by side, his type plants with ones under study.

According to Lloyd (1906) *Tylostoma tortuosum* and *T. Ruhmerianum* are synonyms of *T. volvulatum* but no authentic specimens of these have been seen, hence we cannot say as to the accuracy of Lloyd's assumption. We have examined authentic specimens of *T. Boissieri* and *T. Barbeyanum* and agree with Patouillard that they are synonyms of our species.

Tylostoma volvulatum apparently is a common plant of wide distribution in North Africa, Central Asia, including India, and Central Europe. Coker & Couch (1928) report what they call a slender form of *T. volvulatum* from Puerto Rico in Seaver and Chardon collection no. *142*, but it is very doubtful if this is the true *T. volvulatum*, judging from their description.

Tylostoma volvulatum was abundantly collected from mounds of sandy loam about one mile toward the east of Rohtak town; strangely enough it is rare on the sand hills to the north and south.

For 4 years (1935–1938) the rains in Rohtak District had practically failed and the whole area was in the throes of a very severe famine. In 1938 the monsoons were once again heavy and occurred at the normal time. During this and the succeeding year (1939) *T. volvulatum* was so abundant that bags full of it could be collected without much difficulty. But since then it has gradually disappeared and at the present (1946) it is hard to find many specimens in spite of diligent search. The reason for

this appears simple, because since the soil remained untilled during this period there was ample chance for the plant to establish itself and complete its full growth undisturbed from year to year. It may be noted that even during this period there was sufficient rainfall but it was so irregular that it was of no use to the crops. With the return of normal climatic conditions the areas where the plants formerly thrived were brought under cultivation and thus the soil was ploughed, the plants were frequently uprooted and their rhizomorphs killed by exposure to the severe heat of the summer.

Apparently the spores play a very insignificant role in reproducing this *Tylostoma* and other species with stout rhizomorphs. Ahmad has observed that many species in India cannot tolerate the least disturbance but prefer to retire to the secluded arid regions where they may grow undisturbed from year to year. Long has noticed the same thing in the United States where any disturbance of the surface soil results in the disappearance of species of *Tylostoma* for at least 5–7 years.

As previously stated, in May and June very hot winds blow during the day-time in the Panjab; at times they increase their severity to such an extent as to take the form of dust storms. The strong wind and the dust storms keep the loose sand shifting from one place to another, depositing it around isolated bushes in the form of low sand hills or dunes. During the course of their action they remove the soil from around many plants thereby exposing their root systems. This is a matter of common observation in all sandy regions and has been observed in several areas in the Panjab Plains. Under these conditions the plants of *Tylostoma volvulatum*, at all stages of development, are unearthed and lie scattered on the surface of the soil. Most of the plants of this species collected from Rohtak were found in this condition. During this process several of the sporocarps are unearthed but there are many others which are buried under sand at different depths; the length of the stems usually depends upon the depth of the soil.

Another factor which influences the growth of the plant is the moisture content of the soil. In sandy soil the water percolates easily to the deeper layers which retain it longer than the upper strata, which further lose their water by evaporation. Taking into account this factor we find that the sporocarps which are buried in the superficial layers cannot grow to their full extent and consequently remain dwarfed with thick stems. On the other hand the sporocarps which are buried very deep down continue to grow and complete their full development in normal course. In this case the large fruit bodies are formed and the stipe especially is very long. It is interesting to note that in some individuals exposed to the severe heat of the summer the outer layers of the already formed stipe die and lose their power to elongate further; with the approach of the favorable season the inner layers elongate further while the outer break up and form large irregular scales. This is further substantiated by the study of *Podaxon pistillaris* and *Phellorina inquinans*, two other sand loving species. The

young stages are generally deep seated and provided at the base with very stout rhizomorphs for the absorption of water. This habitat is very essential for these plants as their gleba matures above the surface of the soil. If their origin is superficial it has been observed that the development of the gleba is soon arrested and the plants remain small and stunted. If the fruit bodies start deeper in the soil where water is available even after the rains are over, they assume very large size and the gleba reaches full maturity in due course of time. *Tylostoma volvulatum* differs from these plants in that the stipe begins to elongate only after the gleba has neared maturity. It is common, therefore, to find plants with mature spores in which their stipes have not yet elongated. Often if these plants are buried in moist soil their stipes complete their development. It is interesting to note in this connection that the button stages which were lying exposed to the severe heat of the summer often elongate their stipes when they get buried in moist sand. This *Tylostoma* has thus remarkably adapted itself to this mode of life, and exposure to hot summer sun does not affect it much. The dispersal of the spores takes place when the mature plants are carried from place to place by the strong winds or when they are violently shaken by the sand striking against their peridia.

It may not be out of place here to mention that the size of the fruit bodies of *Lycoperdon pusillum*, another species occurring in sandy soil in the Panjab, also depends upon the amount of water present in the superficial layers of the soil. As this plant is epigeous the effect is more pronounced in this case than in the species discussed above. When the plants grow on raised soil where water cannot collect they are of very small size but in low places where water from adjacent areas collects they become very large. As the time for full development allotted to this plant by nature is short it has a remarkable power of maturing its gleba no matter at what stage its growth is arrested. It stands at a distinct disadvantage when compared to the other species found in the same habitat which are hypogeous in their earlier stages.

The same two factors effect the growth of other species of *Tylostoma*; if the general level of the ground is higher than the surroundings, rain water easily drains off and has little time for percolating into the lower layers. It is especially true of sandy clay and clay soils. The former has been found to behave like the latter when it lies fallow for a long time. The lower layers then become hard and unsuitable for the growth of the larger species of *Tylostoma*, while the superficial layers can harbor only the tiny species so characteristic of the Panjab Plains. Furthermore the rain falls at intervals during which the upper layers soon lose all their moisture and for this reason the *Tylostomas* regularly experience dry and wet periods of short duration even during the rainy season. This seriously affects their growth. For the same reason a species of *Simblum* found in the same habitat takes very long to produce fully grown plants which are then very small in size.

Even when the lower layers are not so hard as to become unfit for large

species of *Tylostoma*, the character of the soil gets modified by the presence of the grass roots. If the soil is covered with annual species like *Aristida mutabilis*, *A. adsenscionis*, *Eragrostis tremula* and *Bulbostylis barbata* the soil is fit for the growth of *Tylostoma volvulatum*, the giant species. It is the perennial species like *Eleusine flagellifera*, *Dactyloctenium scindicum*, *Sporobolus arabicus* and *Cyperus conglomeratus* which debar the larger species of *Tylostoma* from growing there. The root systems of these grasses are so well developed as to form an entangled mass of dead and living roots. In this condition it is unfit for the *Tylostomas* but a thin layer of soil deposited annually harbors a good number of the midget species. This is a favorable resort of *T. evanescens* and *T. vulgare*; the latter, however, prefers the soil with more scattered grass and is consequently bigger in size. Due to the thick mat of grass roots the sporocarps cannot originate in the deeper layers. If by chance any spores should develop in the lower layers the peridia do not reach the surface. In digging out the *Tylostomas*, some individuals are found with curved stipes entangled in the mass of roots.

For the same reason *T. hygrophilum* has a superficial origin as it grows among dense tufts of grass (*Cynodon dactylon*) but in this species the length of the stipe is determined by the height of the grass; although there is no dearth of water yet the sporocarp is not big in size since it is not allowed sufficient lateral growth, being crowded by the grass.

The midget species of *Tylostoma* under discussion might have originated by reduction under the influence of edaphic and climatic factors but now their small size seems to have become fixed. They also have one advantage of growing among grass, since the root system firmly binds the soil and there is no chance of the exposure of the button stages and the rhizomorphs, so they remain undisturbed from year to year. The sporocarps take more than one season to reach maturity and during the dry period they simply lie in a dormant state, resuming their growth in April (after the winter rains), or in June or July (the beginning of the monsoon rains). This explains why, with the first showers of monsoon rains, *Tylostomas* come up in large numbers while late in the season they are absent, possibly only those which started their development rather late during the last year.

The midget species feel the disturbance much more than the larger species and when the soil where they are growing is brought under cultivation they have never been observed again, even if the soil remains undisturbed for a number of years afterwards.

When the monsoon showers are heavy, the peridia may break off and roll about on the ground disseminating spores. In some cases the peridial walls become flaccid when moist and as drops of rain water fall on them clouds of spores are seen escaping through the mouth. The capillitia in which the spores remain entangled probably serve as a check on their dispersion, so that they may not escape all in one lot; after the spores are discharged the peridia often collapse.

In the Panjab Plains most of the species have the granular type of

exoperidium. As the rains generally occur at short intervals, so it is rare to find plants in which the exoperidia is entirely lost. During the monsoon, rains fall in very heavy torrents breaking away the peridia unless they are protected by grass, etc. This explains to some extent why the plants are covered with mud; since under the circumstances explained above there appears to be little or no chance of the adhering sand or mud being washed off.

We have tried to include in this paper all species of *Tylostoma* heretofore reported from India. Butler and Bisby (1931) reported 5 species, but 2 of these, *Tylostoma Bonianum* and *T. pusillum*, apparently have not yet been found in India. The Director of the Royal Botanical Gardens at Kew writes that neither of these is present in the collections at Kew and that apparently the inclusion of *T. pusillum* in the original description by De Toni *in* Saccardo (1888) as being found at Madras was an error, as this species has been reported only from Borneo. Lloyd (1906) reported that he saw what he took to be *T. Bonianum* at Kew but this seems to be not true and the plant he saw was probably a specimen of *T. exasperatum*. In view of the above we have not included these species in our list of *Tylostomas* from India.

This paper is just a beginning on the number of species of *Tylostoma* in India, as a thorough search of this vast region will undoubtedly bring to light many more species.

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BIBLIOGRAPHY

Ahmad, Sultan. 1939. Higher fungi of the Punjab Plains I. The Gasteromyceteae. Jour. Indian Bot. Soc, **18:** 47–58.

————. 1940. Higher fungi of the Panjab Plains II. The Gasteromycetes. Jour. Indian Bot. Soc. **18:** 169–177.

————. 1941. Higher fungi of the Panjab Plains III. The Gasteromycetes. Jour. Indian Bot. Soc. **20:** 135–143.

————. 1941. Gasteromycetes of the Western Himalayas I. Jour. Indian Bot. Soc. **20:** 173–182.

————. 1942. Gasteromycetes of N. W. Himalayas II. Jour. Indian Bot. Soc. **21:** 283–293.

Borszczow, I. 1865. Materialy dla botanicseskoi geografii Aralo-Kaspiiskago kraia. Zapiski Imp. Acad. Nauk St. Petersbourg **7:** 189.

Bresadola, G. 1904. *In* Petri, L. Sul valore diagnostico del capillizio nel genere "Tylostoma" Pers. Ann. Mycol. **2:** 423.

Butler, E. J. & G. R. Bisby. 1931. Fungi of India. Imp. Counc. Agric. Res. Sci. Monogr. **1:** 138.

Coker, W. C. & J. N. Couch. 1928. The Gasteromycetes of the Eastern United States and Canada. pp. 149–159. Univ. N. C. Press.

Cooke, M. C. 1888. *In* Aitchison, J. E. T. The botany of the Afghan Delimitation Commission. Trans. Linn. Soc. Lond. Ser. 2 (Bot.) **3:** 129.

Cooke, M. C. & J. B. Ellis. 1878. New Jersey fungi. Grevillea **6:** 82.

Cunningham, G. H. 1944. The Gasteromycetes of Australia and New Zealand. pp. 179–189. Privately printed.

De Toni, J. B. 1888. Tylostoma *in* Saccardo, P. A. Sylloge Fungorum **7:** 60–65.

Fischer, E. 1933. Gastromyceteae *in* Engler, A. & K. Prantl. Die Natürlichen Pflanzenfamilien. Ed. 2. **7a:** 46–48.

Hennings, P. 1901. Aliquot fungi Africae borealis. Hedwigia **40:** (99).

Hollós, L. 1914. Gasteromycetes Hungariae. Die Gasteromyceten Ungarns. pp. 147–149. O. Weigel.

Lloyd, C. G. 1906. Mycological Writings **2:** The Tylostomeae. pp. 9–26.

Long, W. H. 1944. Studies in the Gasteromycetes X. Seven new species of Tylostoma. Mycologia **36:** 318–339.

————. 1946. Studies in the Gasteromycetes XII. Five species of Tylostoma with membranous exoperidia. Mycologia **38:** 77–90.

————. 1946. Studies in the Gasteromycetes XIII. The types of Miss White's species of Tylostoma. Mycologia **38:** 171–179.

————. 1947. Studies in the Gasteromycetes XV. Notes on new or rare species of Tylostoma. Lloydia [in press].

Montagne, J. C. 1837. Centurie des plantes cellulaires exotiques nouvelles. Ann. Sci. Nat. (Bot.) Ser. 2, **8:** 362.

Petri, L. 1909. Tylostoma *in* Gasterales. Flora Italica Cryptogama. fasc. **5:** 115–131.

Ridgway, R. 1912. Color Standards and Color Nomenclature.

Sorokin, N. W. 1884. Materialy dla flory Srednei Asii. Bull. Soc. Imp. Nat. Moscou **1884** (1): 40.

————. 1890. Matériaux pour la flore cryptogamique de l'Asie Centrale. Rev. mycol. **12:** 49–55.

White, V. S. 1901. The Tylostomaceae of North America. Bull. Torrey Bot. Club **28:** 421–436.

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CHINESE FUNGI COLLECTED BY S. Y. CHEO

C. G. HANSFORD

The fungi enumerated below were collected in various parts of China by S. Y. Cheo, and were kindly forwarded to the writer by Dr. D. H. Linder from the Farlow Herbarium, Harvard University, to which herbarium the type specimens have been returned.

1. **Irene calostroma** (Desm.) Hoehn. Ann. Mycol. **16:** 213. 1918.

FIGURE 1

On *Rubus* sp., Kwangsi Province, Lao Shan, Ling Yuin Hsien, 13.3.1933, *Cheo 1615a*.

Colonies epiphyllous, rarely also hypophyllous, black, thin, orbicular, scattered, up to 3 mm. diam., sometimes confluent, not causing leafspots. Mycelium of substraight dark brown hyphae 6–8μ thick, the cells mostly 25–40μ long, branching opposite or irregular at 45–90°, loosely reticulate. Capitate hyphopodia alternate, more or less antrorse, straight or bent, 25–38μ long, stalk cell cuneate 10–16μ long, head cell irregularly 3–5-lobed, 12–20 x 12–20μ. Mucronate hyphopodia few, scattered, mostly alternate, squat ampulliform, 13–18 x 7–8μ, neck short 3–4μ thick. Perithecia loosely scattered, black, globose, 200–250μ diam., with 6–10 suberect larviform appendages, cylindric with bluntly conoid apex, more or less bent, dark brown, transversely striate, continuous, up to 70μ long by about 20μ thick at the base. Spores bent cylindric with rounded ends, dark brown, 3-septate, constricted, 41–51 x 13–15μ (average 47 x 13.5μ).

2. **Irene styracicola** Yamamoto, var. **minor** var. nov.

FIGURE 2

Plagulae epiphyllae atrae orbiculares leves, usque ad 1 mm. diam., vel confluentes. Mycelium ex hyphis atrobrunneis sinuosis 6–7μ crassis (cellulis plerumque circa 25μ longa) opposite vel irregulariter ramosis (45–90°) laxe reticulatis compositum. Hyphopodia capitata alternata, 16–36μ longa, recta vel curvula, plus minusve antrorsa, cellula basali cuneata vel cylindracea, 4–20μ longa, recta vel curvata, cellula apicali raro ovata integraque, plerumque 3–4–angulosa vel sub–3–4–lobata, 12–17 x 11–18μ. Hyphopodia mucronata pauca dispersa alternata ampullacea 14–20 x 7–8μ, collo brevi 3.5–4μ crasso. Setae myceliales nullae. Perithecia in centro plagularum laxe aggregata, atra globosa usque ad 220μ diam., appendicibus corniformis 5–12, suberectis 40–60μ longis et basi 20–30μ crassis, superne attenuatis, apice obtusis hamatis, continuis, tenuiter tunicatis, brunneis, transverse striatis ornata. Sporae ellipsoideae utrinque rotundatae, atrobrunneae, curvulae, 3–septatae, constrictae 38–44 x 12–15μ (av. 41.5 x 14μ).

Hab. in foliis *Styracis benzoin*, Kweichow Province, Liang Feng Yah, Tsunyi Hsien, 31.7.1931, *Cheo 180 p.p.*

Colonies epiphyllous black orbicular smooth, on pale reddish brown leafspots not visible through the leaf, up to 1 mm. diam., or confluent, mixed with those of *Meliola kweichowensis* Hansf. Mycelium of somewhat sinuous dark brown hyphae 6–7μ thick, the cells mostly about 25μ long, branching opposite or irregular at 45–90°, loosely reticulate. Capitate hyphopodia alternate, 16–35μ long, straight or bent; stalk cell cuneate to cylindric, 4–20μ long, straight or bent; head cell rarely ovate and entire, usually 3–4-angled or shallowly 3–4-lobed, 12–17 x 11–18μ. Mucronate hyphopodia few, scattered amongst the capitate hyphopodia, alternate, ampulliform, 14–20 x 7–8μ, with short neck 3.5–4μ thick. Perithecia in a loose central group, black globose, up to 220μ diam., with 5–12 suberect larviform appendages 40–60μ long by 20–30μ thick at the base, attenuate to the blunt hamate apex, with thin brown transversely striate wall, apparently not septate, arising from the sides and upper half of the perithecial wall. Spores bent ellipsoid with rounded ends, dark brown, 3-septate, constricted, 38–44 x 12–15μ (average 41.5 x 14μ).

3. **Irenopsis benguetensis** Stev. & Rold. Philipp. Journ. Sci. **56:** 49. 1935.

FIGURE 3

On *Ficus* sp., Kwangsi Province, Ling Wang Shan (San Kiang Hsien) 17.9.1933, *Cheo 2784.*

We have not seen type material from the Philippines for direct comparison with the present collection, which appears to satisfy the original description: —

Colonies amphigenous, black, 1–3 mm. diam., or numerous and confluent, thin. Mycelium of dark brown slightly sinuous hyphae 7–9μ thick, the cells mostly 25–35μ long, branching alternate at 45–90°, loosely reticulate. Capitate hyphopodia alternate, straight or bent, 22–37μ long, stalk cell cuneate to cylindric, 6–20μ long, head cell from subglobose to irregularly and shallowly 3–4–lobed 13–20 x 12–17μ. Mucronate hyphopodia none in some colonies, in others numerous, on separate hyphae, alternate, rarely opposite, ampulliform, straight or bent, 19–25 x 7–10μ, neck 4μ thick. Mycelial setae none. Perithecia scattered, black, globose 120–150μ diam., with 3–10 erect or spreading, black, straight or bent setae 80–160 x 9–10μ, attenuate to 6–7μ at the simple bent (not hamate or coiled) apex, 4–5–septate, rough scaly. Spores cylindric dark brown with rounded ends, 4–septate constricted 37–43 x 14–17μ (av. 39 x 15.5μ). The perithecial setae are formed at a very early stage in the development of the perithecia.

4. **Irenina Buddleiae,** sp. nov.

FIGURE 4

Plagulae amphigenae, plerumque epiphyllae, orbiculares densae atrae, circa 1 mm. diam., saepe numerosae et plus minusve confluentes. Mycelium ex hyphis atrobrunneis sinuosis 7–8μ crassis, (cellulis plerumque circa 20μ longis) opposite vel irregulariter ramosis (60–90°) dense reticulatis compositum. Hyphopodia capitata alternata, recta vel curvata, 18–31μ longa, cellula basali cylindracea 5–15μ longa, cellula apicali subglo-

bosa vel clavata, integra 13–18 x 9–15μ. Hyphopodia mucronata pauca, in hyphis distinctis evoluta, opposita vel alternata, ampullacea, plus minusve curvata 12–17 x 6–7μ, collo 3μ crasso. Perithecia in centro plagularum laxe aggregata, atra globosa, usque ad 175μ diam., cellulis parietis conoideis vel mammillatibus, usque ad 30μ alt., raro in processibus cylindraceis usque ad 40μ alt. productis. Setae nullae. Sporae atrobrunneae cylindraceae utrinque rotundatae, 4–septatae constrictae 33–37 x 13–16μ (av. 35 x 14.5μ).

Hab. in foliis *Buddleiae* sp., Kwangsi Province, Ta Tseh Shan (Yung Hsien) 29.10. 1933, *Cheo 2940*.

Colonies amphigenous, mostly epiphyllous, orbicular, about 1 mm. diam., dense, often numerous and more or less confluent over the leaf. Mycelium of dark brown sinuous hyphae 7–8μ thick, the cells mostly about 20μ long, branching opposite or irregular at 60–90°, closely reticulate. Capitate hyphopodia alternate, straight or bent, 18–31μ long; stalk cell cylindric 5–15μ long; head cell subglobose to clavate, entire, 13–18 x 9–15μ. Mucronate hyphopodia few, on separate hyphae, opposite or alternate, ampulliform, more or less bent, 12–17 x 6–7μ neck 3μ thick. Setae none. Perithecia in a loose central group, black, globose, up to 175μ diam., the surface cells about 35μ diam., conoid to mammillate and up to 30μ high, rarely produced into short cylindric processes up to 40μ high. Spores dark brown, cylindric with rounded ends, 4-septate constricted 33–37 x 13–16μ (average 35.5 x 14.5μ).

5. (?)**Irenina Castanopsidis** sp. nov.

FIGURE 5

Plagulae amphigenae, plerumque epiphyllae, atrae, leves densae, usque ad 7 mm. diam., interdum confluentes. Mycelium ex hyphis atrobrunneis subrectis vel leniter sinuosis 8–9μ crassis, (cellulis plerumque 20–30μ longis) opposite ramosis (60–90°) dense reticulatis compositum. Hyphopodia capitata alternata, suberecta vel antrorsa, recta vel curvata, 22–40μ longa, cellula basali cylindracea 8–12μ longa, cellula apicali irregulariter cylindracea, saepe fortiter curvata, lobata, 18–30 x 12–16μ. Hyphopodia mucronata pauca, alternata vel opposita, dispersa, curvata ampullacea 16–22 x 8μ, collo 3–4μ crasso. Setae nullae. Perithecia matura non visa. Sporae atrobrunneae, oblongo-ellipsoideae utrinque late rotundatae, 4–septatae, constrictae, 46–53 x 22–25μ (av. 49 x 23μ).

Hab. in foliis *Castanopsidis tibetanae*, Kweichow Province, Ma Tsao Ho, Chiang K'ou Hsien, Fan Ching Shan, 25.10.1931, *Cheo 758*.

Colonies amphigenous, mostly epiphyllous, black smooth dense, up to 7 mm. diam., sometimes confluent. Mycelium of dark brown substraight to slightly sinuous hyphae 8–9μ thick, the cells mostly 20–30μ long, branching usually opposite at 60–90°, closely reticulate. Capitate hyphopodia alternate, at wide angles or somewhat antrorse, straight or bent, 22–40μ long; stalk cell cylindric 8–12μ long; head cell very irregularly cylindric, often much bent, lobate, 18–30 x 12–16μ. Mucronate hyphopodia few, scattered amonst the capitate, alternate or opposite, bent ampulliform 16–22 x 8μ, neck 3–4μ thick. Mature perithecia not seen. Spores dark brown, oblong-ellipsoid with broadly rounded ends, 4-septate, strongly constricted, 46–53 x 22–25μ (average 49 x 23μ).

Further collections of this species are needed to establish with certainty to which of the genera *Irene*, *Irenopsis* and *Irenina* it belongs.

6. **Irenina Cheoi** sp. nov.

FIGURE 6

Plagulae amphigenae atrae densae orbiculares, usque ad 4 mm. diam., vel. confluentes, in hypophyllo saepe marginaliter extensae. Mycelium ex hyphis atrobrunneis rectis 7–9μ crassis (cellulis 20–30μ longis) opposite denseque ramosis (30–60°) dense reticulatis compositum, subsolidum. Hyphopodia capitata alternata antrorsa, recta vel curvata, 17–37μ longa, cellula basali cylindracea recta vel curvata 4–17μ longa, cellula apicali irregulariter stellatim 3–5–lobata, versiformia 10–22 x 12–21μ. Hyphopodia mucronata pauca dispersa alternata ampullacea, plus minusve curvata 14–20 x 7–9μ, collo brevi 4μ crasso. Setae nullae. Perithecia dispersa atra globosa 200–290μ diam., cellulis parietis mammillatibus vel in processibus conoideis usque ad 40μ alt. productis, circa 40μ diam. Sporae atrobrunneae ellipsoideae utrinque rotundatae, curvulae, 3–septatae, leniter constrictae 48–56 x 20–22μ (av. 52 x 21μ).

Hab. in foliis *Fici* sp. indet., Kweichow Province, Ma Tsao Ho (Chiang K'ou Hsien) (Fan Ching Shan), 16.10.1931, *Cheo 715*.

Colonies amphigenous, black, dense, orbicular, up to 4 mm. diam. or confluent, on the lower surface often elongate along the leaf margin. Mycelium of dark brown straight hyphae 7–9μ thick, the cells mostly 20–30μ long, branching opposite, close, at 30–60°, densely reticulate, almost solid. Capitate hyphopodia alternate, more or less antrorse, straight or bent, 17–37μ long; stalk cell cylindric, straight or bent, 4–17μ long; head cell irregularly stellately 3–5-lobed, variable in shape and size, 10–22 x 12–21μ. Mucronate hyphopodia few, scattered amongst the capitate, alternate, ampulliform more or less bent, 14–20 x 7–9μ, neck short 4μ wide. Setae none. Perithecia scattered black globose 200–290μ diam., the surface cells mammillate or with bent conoid processes up to 40μ high, the cells about 40μ diam. at the base. Spores dark brown, bent ellipsoid with rounded ends, 3-septate, slightly constricted, 48–56 x 20–22μ (average 52 x 21μ).

7. **Irenina Lonicerae** sp. nov.

FIGURE 7

Plagulae amphigenae plerumque epiphyllae, atrae orbiculares 1–2 mm. diam. vel numerosae confluentesque. Mycelium ex hyphis atrobrunneis subrectis vel leniter sinuosis 7–9μ crassis (cellulis plerumque 20–25μ longis) opposite vel irregulariter ramosis (45–60°) laxe vel subdense reticulatis compositum. Hyphopodia capitata alternata, plus minusve antrorsa, recta vel curvata 17–24μ longa, cellula basali cuneata vel cylindracea, recta vel curvata, 4–8μ longa, cellula apicali subglobosa, late clavata vel plerumque 3–angulosa vel sub–3–lobata, 12–17 x 9–15μ. Hyphopodia mucronata in hyphis paucis inter hyphopodia capitata interspersa, opposita, plus minusve curvata ampullacea 15–22 x 7–9μ, collo elongato 3μ crasso. Perithecia in centro plagularum aggregata, atra globosa usque ad 170μ diam., cellulis parietis mammillatibus, circa 40μ diam. et usque ad 25μ alt. Sporae atrobrunneae cylindraceae vel ellipsoideae utrinque rotundatae, 4–septatae constrictae 35–42 x 15–17μ (av. 38 x 16μ).

Hab. in foliis *Lonicerae* sp. indet., Kweichow Province, Miao Wang (Chiang K'ou Hsien) (Fang Ching Shan) 27.9.1931, *Cheo 605*.

Colonies amphigenous, mostly epiphyllous, black, rounded, 1–2 mm. diam. or numerous and confluent. Mycelium of dark brown substraight to somewhat sinuous hyphae 7–9μ thick, the cells mostly 20–25μ long, branching opposite or irregular at 45–60°, loosely to closely reticulate. Capitate hyphopodia alternate, more or less antrorse, straight or bent,

17–24μ long; stalk cell cuneate to cylindric, straight or bent, 4–9μ long; head cell subglobose, wide clavate or more usually shallowly 3-angled to sublobed, 12–17 x 9–15μ. Mucronate hyphopodia on few hyphae, mixed with capitate, usually opposite, more or less bent ampulliform, 15–22 x 7–9μ, neck elongate 3μ thick. Perithecia in a central group, black globose, up to 170μ diam.; surface cells mammillate, about 40μ diam, and up to 25μ high. Spores dark brown, cylindric to subellipsoid with rounded ends, 4-septate constricted 35–42 x 15–17μ (average 38.5 v 16μ).

8. **Irenina quercina** sp. nov.

FIGURE 8

Plagulae epiphyllae, raro etiam hypophyllae, atrae orbiculares, densae leves, usque ad 5 mm. diam., numerosae et interdum confluentes. Mycelium ex hyphis atrobrunneis subrectis 7–8μ crassis (cellulis plerumque 12–20μ longis) opposite ramosis (60–90°) densissime reticulatis compositum. Hyphopodia capitata alternata (rarissime opposita) 17–23μ longa, late antrorsa, cellula basali cylindracea 3–7μ longa cellula apicali cylindracea vel leniter clavata, integra vel raro irregulariter angulosa vel sublobata, apice plerumque late rotundata, 12–17 x 8–14μ, recta vel curvata. Hyphopodia mucronata rara alternata ampullacea 17–21 x 7–9μ, collo curvato 3–4μ crasso. Setae nullae. Perithecia in centro plagularum laxe aggregata, atra globosa 200–250μ diam. cellulis parietis obtuse conoideis, circa 35μ diam., usque ad 15μ alt. Sporae ellipsoideae atrobrunneae utrinque rotundatae, 4–septatae, fortiter constrictae 45–53 x 18–23μ (av. 49 x 21μ).

Hab. in foliis *Quercus* sp., Anhwei Province, Hai Hung Ling, Ch'ing Yang Hsien, Chiu Hua Shan, 14.11.1932, *Cheo 1554.*

Colonies epiphyllous, very rarely also hypophyllous, black orbicular dense smooth, up to 5 mm. diam., numerous and sometimes confluent. Mycelium of substraight dark brown hyphae 7–8μ thick, the cells mostly 12–20μ long, branching opposite at 60–90°, very densely reticulate. Capitate hyphopodia alternate (very rarely opposite) 17–23μ long, at wide angles; stalk cell cylindric 3–7μ long; head cell cylindric to slightly clavate, entire or rarely somewhat irregularly angulose to sublobed, apex usually widely rounded 12–17 x 8–14μ, straight or bent. Mucronate hyphopodia very few, ampulliform, alternate, 17–21 x 7–9μ, neck bent, 3–4μ thick. Setae none. Perithecia in a loose central group, black, globose 200–250μ diam., the surface cells bluntly conoid, about 35μ diam. and up to 15μ high. Spores ellipsoid, dark brown, with rounded ends, 4-septate rather strongly constricted, 45–53 x 18–23μ (average 49.5 x 21μ).

9. **Irenina Rosae** sp. nov.

FIGURE 9

Plagulae epiphyllae atrae dispersae orbiculares usque ad 2 mm. diam., saepe numerosae confluentesque, tenues vel subdensae. Mycelium ex hyphis atrobrunneis, sinuosis vel flexuosis 6–7.5μ crassis (cellulis plerumque 20–25μ longis) opposite vel irregulariter ramosis (45–90°) laxe vel subdense reticulatis compositum. Hyphopodia capitata alternata saepe irregulariter curvata, 15–22μ longa, cellula basali cylindracea vel cuneata, recta vel curvata 3–10μ longa, cellula apicali versiformia, recta vel curvata, ex clavata integraque irregulariter 3–angulosa vel sublobata, apice rotundata acuta vel late truncata, 9–15 x 8–14μ. Hyphopodia mucronata dispersa, interdum numerosissima, alternata, plus minusve curvata, conoidea vel ampullacea, 13–20 x 7–8μ, collo 3–3.5μ crasso. Setae nullae. Perithecia dispersa, atra globosa verrucosa 200–240μ diam., cellulis parietis obtuse conoideis vel mammillatibus, circa 45μ diam. usque ad 20μ alt. Sporae

atrobrunneae cylindraceae utrinque rotundatae, plus minusve curvatae, 3–septatae, leniter constrictae 34–40 x 11–13μ (av. 37 x 12μ).

Hab. in foliis *Rosae roxburghii*, Kweichow Province, Ta Ho Yen (Chiang K'ou Hsien) (Fan Ching Shan) 14.9.1931, *Cheo 473*. (**typus**); Kweichow Province, Liang Feng Yah (Taunyi Hsien) 1.8.1931, *Cheo 184*; *loc. cit.* 31.7.1931, *Cheo 172*.

Colonies epiphyllous black scattered rounded, up to 2 mm. diam., or numerous and subconfluent, thin to subdense. Mycelium of crooked or sinuous dark brown hyphae 6–7.5μ thick, the cells mostly 20–25μ long, branching opposite or irregular at 45–90°, loosely to rather closely reticulate. Capitate hyphopodia alternate, usually more or less irregularly bent, 15–22μ long; head cell cylindric to cuneate, straight or bent, 3–10μ long; head cell very variable, straight or bent, from clavate to irregularly triangular or sublobed, apex rounded, acute or broadly truncate, 9–15 x 8–14μ. Mucronate hyphopodia scattered, in some colonies exceeding the capitate hyphopodia; alternate, more or less bent, conoid to ampulliform, 13–20 x 7–8μ the neck 3–3.5μ thick. Perithecia scattered black globose verrucose 200–240μ diam., the surface cells bluntly conoid to mammillate, about 45μ diam. and up to 20μ high; appendages none. Spores dark brown, cylindric with rounded ends, more or less bent, 3-septate, slightly constricted 34–40 x 11–13μ (average 37 x 12μ).

10. **Meliola Actinodaphnes** sp. nov.

FIGURE 10

Plagulae amphigenae atrae densae orbiculares, usque ad 4 mm. diam. Mycelium ex hyphis atrobrunneis, in epiphyllo subrectis, in hypophyllo flexuosis vel geniculatis, 8–11μ crassis (cellulis plerumque 15–25μ longis) opposite ramosis (60–90°) dense reticulatis compositum. Hyphopodia capitata alternata, recta vel curvata, 20–38μ longa, suberecta vel leniter antrorsa, cellula basali cylindracea 5–14μ longa, cellula apicali cylindraceo-clavata vel irregularia, apice rotundata vel truncata, recta vel varie curvata, 11–25 x 11–19μ. Hyphopodia mucronata dispersa, alternata vel opposita, breviter ampullacea, 14–22 x 8–11μ, collo curvato 4μ crasso. Setae myceliales dispersae et juxta perithecia aggregatae, erectae rectae atrae simplices acutae, usque ad 800 x 10–11μ. Perithecia dispersa atra globosa verrucosa usque ad 240μ diam. Sporae atrobrunneae ellipsoideae utrinque rotundatae, 4–septatae constrictae 52–65 x 23–28μ (av. 58 x 26μ).

Hab. in foliis *Actinodaphnes* sp., Kwangsi Province, Loh Hoh Tsuen, Ling Yuin Hsien, 13.3.1933, *Cheo 1608*.

Colonies amphigenous black dense orbicular, up to 4 mm. diam. Mycelium on upper surface of substraight hyphae, on lower surface the hyphae very crooked to geniculate, dark brown 8–11μ thick, the cells mostly 15–25μ long; branching mostly opposite at 60–90°, closely reticulate. Capitate hyphopodia alternate, straight or bent, 20–38μ long; stalk cell cylindric 3–14μ long; head cell cylindric-clavate to irregular, rounded or truncate at the apex, straight or variously bent 11–25 x 11–19μ. Mucronate hyphopodia scattered amongst the capitate, alternate or opposite, squat ampulliform, 14–22 x 8–11μ, with bent neck 4μ thick. Mycelial setae scattered and also grouped around the perithecia, erect straight simple black acute up to 800μ long, 10–11μ thick at the base. Perithecia scattered, black globose verrucose, up to 240μ diam. Spores dark brown,

ellipsoid with rounded ends, 4-septate, constricted 52–65 x 23–28μ (average 58 x 26μ).

11. **Meliola Brandisiae** sp. nov.

FIGURE 11

Plagulae epiphyllae atrae subdensae 2–4 mm. diam. vel confluentes, subvelutinae. Mycelium ex hyphis atrobrunneis, subrectis vel leniter undulatis 7–8μ crassis (cellulis 20–30μ longis) opposite ramosis (45–90°) dense reticulatis compositum. Hyphopodia capitata alternata, plerumque recta, 18–28μ longa, cellula basali cuneata 8–10μ longa, cellula apicali ovata vel clavato-cylindracea, integra, apice late rotundata, 12–19 x 8–11μ. Hyphopodia mucronata in hyphis paucis inter hyphopodia capitata interspersa, opposita vel alternata, breviter ampullacea 13–18 x 6–7μ, collo 3μ crasso. Setae myceliales modice numerosae, dispersae et juxta perithecia aggregatae, erectae rectae simplices atrae 200–300 x 7–8μ obtusae. Perithecia dispersa atra globosa verrucosa usque ad 170μ diam. Sporae atrobrunneae cylindraceae utrinque rotundatae, 4–septatae constrictate 34–40 x 13–16μ (av. 36 x 14.5μ).

Hab. in foliis *Brandisiae* sp., Kwangsi Province, Loh Hoh Tsuen, Ling Yuin Hsien, 13.3.1933, *Cheo 1624.*

Colonies epiphyllous, black, rather dense, 2–4 mm. diam., or confluent. Mycelium of substraight or slightly undulate dark brown hyphae 7–8μ thick, the cells 20–30μ long, branching opposite at 45–90°, closely reticulate. Capitate hyphopodia alternate, usually straight, 18–28μ long; stalk cell somewhat cuneate 6–10μ long; head cell ovate to clavate-cylindric, entire, usually broadly rounded at the apex, 12–19 x 8–11μ. Mucronate hyphopodia on few hyphae, mixed with capitate, opposite or alternate, squat ampulliform, 13–18 x 6–7μ, with short neck 3μ thick. Mycelial setae fairly numerous, scattered and also grouped around the perithecia, erect, straight, simple obtuse black, 200–300 x 7–8μ. Perithecia scattered black globose verrucose, up to 170μ diam. Spores dark brown, cylindric with rounded ends, 4-septate constricted 34–40 x 13–16μ (average 36.5 x 14.5μ).

12. **Meliola Castanopsidis** sp. nov.

FIGURE 12

Plagulae hypophyllae atrae tenues usque ad 20 mm. diam., tenuiter velutinae. Mycelium ex hyphis atrobrunneis flexuosis vel geniculatis, 4.5–6μ crassis, (cellulis plerumque 20–30μ longis) irregulariter ramosis, interdum dichotomis, laxe reticulatis compositum. Hyphopodia capitata alternata vel opposita (–30%), post septum hyphae efformata, plus minusve curvata 12–23μ longa, cellula basali cylindracea curvata 3–9μ longa, cellula apicali cylindracea clavata vel rotundato–3–anguloso, plerumque integra, raro sublobata, saepe fortiter curvata, 8–14 x 6–10μ. Hyphopodia mucronata rara ampullacea alternata 14–18 x 5–6μ collo curvato 3μ crasso. Setae myceliales tenuiter dispersae et juxta perithecia aggregatae, erectae rectae opace atrae 250–400 x 7–8μ, apice 2–4–dentatae (–8μ), raro breviter 2–furcatae (–10μ) et ramis dentatis. Perithecia dispersa atra globosa verrucosa usque ad 195μ diam. Sporae ellipsoideae vel subfusoideae utrinque rotundatae, curvatae, atrobrunneae, 4–septatae, leniter constrictae, 45–56 x 16–20μ (av. 50 x 19μ), cellula centrale majore.

Hab. in foliis *Castanopsidis tibetanae*, Kweichow Province, Ma Tsao Ho, Chiang K'ou Hsien, Fan Ching Shan, 25.10.1931, *Cheo 758.*

Colonies hypophyllous black thin up to 20 mm. diam., thinly velvety. Mycelium of dark brown very crooked hyphae 4.5–6μ thick, the cells

mostly 20–30μ long, branching irregular, sometimes dichotomous, loosely reticulate. Capitate hyphopodia alternate or opposite, formed behind the septum of the parent cell, more or less bent, 12–23μ long; stalk cell cylindric, more or less bent, 3–9μ long; head cell cylindric clavate or rounded-triangular, usually entire, rarely sublobed, often sharply bent 8–14 x 6–10μ. Mucronate hyphopodia rare, scattered amongst the capitate, ampulliform, alternate 14–18 x 5–6μ neck bent 3μ thick. Mycelial setae thinly scattered and also grouped around the perithecia, erect, opaque black, straight 250–400 x 7–8μ, apex 2–4-dentate to 8μ or rarely shortly 2-furcate to 10μ with the branches dentate. Perithecia scattered black globose verrucose, up to 195μ diam. Spores ellipsoid to subfusoid with rounded ends, dark brown, 4-septate, slightly constricted, 45–56 x 16–20μ (average 50 x 19μ), the middle cell considerably the largest.

This occurs mixed with *Irenina Castanopsidis*, from which it differs markedly in mycelial characters, in the presence of setae and in its very characteristic spores. The dichotomous branching of the hyphae and the formation of the capitate hyphopodia behind the septum of the parent cell are very unusual characters in the *Meliola* group of genera.

13. **Meliola Koelreuteriae** sp. nov.

FIGURE 13

Plagulae amphigenae, plerumque epiphyllae, interdum caulicolae, tenues, orbiculares 1–3 mm. diam., saepe numerosae confluentesque. Mycelium ex hyphis atrobrunneis subrectis vel sinuosis 6–7μ crassis (cellulis plerumque 20–25μ longis) opposite ramosis (45–90°) laxe reticulatis compositum. Hyphopodia capitata alternata, suberecta, plerumque recta, 11–18μ longa, cellula basali cylindracea 3–7μ longa, cellula apicali subglobosa vel ovato-clavata, integra 7–13 x 7–11μ. Hyphopodia mucronata numerosa dispersa opposita vel alternata anguste ampullacea, plus minusve curvata 16–22 x 6–8μ, collo elongato 3μ crasso. Setae myceliales dispersae erectae rectae atrae 200–260 x 7–8μ, apice 2–5–dentato-cristatae (2–11μ, interdum 2–furcatae (–10μ). Perithecia dispersa atra globosa verrucosa usque ad 190μ diam. Sporae atrobrunneae cylindraceae vel subellipsoideae utrinque rotundatae 4–septatae constrictae 35–42 x 14–17μ (av. 38.5 x 16μ).

Hab. in foliis *Koelreuteriae* sp., Kwangsi Province, Ta Tseh Shan (Yung Hsien), 19.8.1933, *Cheo 2522.*

Colonies amphigenous, mostly epiphyllous, sometimes also caulicolous, thin orbicular 1–3 mm. diam., often numerous and confluent. Mycelium of substraight to more or less sinuous dark brown hyphae 6–7μ thick, the cells mostly 20–25μ long, branching usually opposite at 45–90°, loosely reticulate. Capitate hyphopodia alternate only, at wide angles, usually straight, 11–18μ long; stalk cell cylindric 3–7μ long, head cell subglobose to ovate-clavate, entire, 7–13 x 7–11μ. Mucronate hyphopodia rather numerous, scattered amongst the capitate, opposite or alternate, narrow ampulliform, more or less bent, 16–22 x 6–8μ, with elongate neck 3μ thick. Mycelial setae scattered erect straight black 200–260 x 7–8μ, the apex 2–5-dentate-cristate 2–11μ, or sometimes 2-furcate to 10μ and the branches dentate. Perithecia scattered black globose verrucose, up to 190μ diam. Spores dark brown cylindric to subellipsoid with rounded ends, 4-septate constricted, 35–42 x 14–17μ (average 38.5 x 16μ).

14. **Meliola kweichowensis** sp. nov.

FIGURE 14

Plagulae epiphyllae tenues atrae 1–3 mm. diam. vel confluentes. Mycelium ex hyphis atrobrunneis subrectis 4.5–6μ crassis (cellulis plerumque 20–25μ longis) opposite ramosis (60–90°) laxe reticulatis compositum. Hyphopodia capitata alternata plus minusve antrorsa, 10–13μ longa, recta, cellula basali cylindracea 2–5μ longa, cellula apicali globosa integra 8–10μ diam. Hyphopodia mucronata dispersa opposita vel alternata, ampullacea, plus minusve curvata 13–18 x 6–8μ, collo 3μ crasso. Setae myceliales fere omnino juxta perithecia evolutae, erectae atrae rectae simplices, obtusae vel subacutae, usque ad 280 x 8μ. Perithecia laxe dispersa atra globosa verrucosa usque ad 140μ diam. Sporae atrobrunneae cylindraceae utrinque rotundatae, 4–septatae constrictae 29–36 x 11–13μ (av. 33 x 12μ).

Hab. in foliis *Styracis benzoin*, Kweichow Province, Liang Feng Yah (Taunyi Hsien) 31.7.1931, *Cheo 180 p.p.*

Colonies epiphyllous thin black 1–3 mm. diam. or confluent. Mycelium of substraight dark brown hyphae 4.5–6μ thick, the cells mostly 20–25μ long, branching opposite at 60–90°, loosely reticulate. Capitate hyphopodia alternate, more or less antrorse, 10–13μ long, straight; stalk cell cylindric 2–5μ long; the head cell globose entire 8–10μ diam. Mucronate hyphopodia scattered, opposite or alternate, ampulliform, more or less bent, 13–18 x 6–8μ, the neck 3μ thick. Mycelial setae almost entirely grouped around the perithecia, erect black straight simple obtuse to subacute, up to 280 x 8μ. Perithecia loosely scattered, black globose verrucose, up to 140μ diam. Spores dark brown, cylindric with rounded ends, 4-septate, constricted, 29–36 x 11–13μ (average 33 x 12μ).

15. **Meliola symplocicola** Yamamoto, var. **chinensis** var. nov.

FIGURE 15

Plagulae amphigenae tenues orbiculares usque ad 4 mm. diam. vel confluentes. Mycelium ex hyphis atrobrunneis subrectis vel leniter sinuosis 6–7μ crassis (cellulis plerumque 25–30μ longis) opposite ramosis (60–90°) laxe reticulatis compositum. Hyphopodia capitata alternata 18–30μ longa, recta vel curvata, suberecta, cellula basali cylindracea 4–9μ longa, recta vel curvata, cellula apicali cylindracea apice rotundata, saepe curvata, interdum subuncinata, 14–22 x 9–11μ. Hyphopodia mucronata dispersa opposita vel alternata, anguste ampullacea 18–28 x 7–9μ, collo elongato curvato 3μ crasso. Setae myceliales juxta perithecia aggregatae et in mycelio laxe dispersae, haud numerosae, erectae rectae atrae simplices acutae 300–560 x 9–10μ. Perithecia dispersa atra globosa verrucosa usque ad 170μ diam. Sporae atrobrunneae cylindraceae utrinque rotundatae 4–septatae constrictae 38–46 x 17–21μ (av. 42 x 19μ).

Hab. in foliis *Symploci, setchuenensis*, Kweichow Province Huei Hsiang P'ing, Chiang K'ou Hsien, Fan Ching Shan, 2.10.1931, *Cheo 632.*

Colonies amphigenous, thin, orbicular, up to 4 mm. diam. or confluent. Mycelium of substraight to slightly sinuous dark brown hyphae 6–7μ thick, the cells mostly 25–30μ long, branching mostly opposite at 60–90°, loosely reticulate. Capitate hyphopodia alternate 18–30μ long, straight or bent, at wide angles; stalk cell cylindric 4–9μ long, straight or bent; head cell cylindric with entire rounded apex, often more or less bent, sometimes uncinate, 14–22 x 9–11μ. Mucronate hyphopodia scattered amongst the capitate, opposite or alternate, narrow ampulliform 18–28 x 7–9μ, neck elongate, bent or contorted, 3μ thick. Mycelial setae grouped around

the perithecia and thinly scattered over the mycelium, not numerous, erect straight simple acute 300–560 x 9–10μ. Perithecia scattered black globose slightly verrucose, up to 170μ diam. Spores dark brown cylindric with rounded ends, 4-septate constricted 38–46 x 17–21μ, (average 42 x 19μ).

16. **Asterina Brandisiae** sp. nov.

FIGURE 16

Plagulae epiphyllae usque ad 1 mm. diam., aegre perspicues atrae tenues leves, interdum confluentes. Mycelium ex hyphis atrobrunneis 4–5μ crassis (cellulis circa 20μ longis) laxe reticulatis, primariis subrectis, aliis undulatis vel flexuosis, laxe reticulatis compositum. Hyphopodia continua, alternata vel unilateralia, 5–8μ longa, 6–11μ crassa, 3–6–lobata, symmetricalia vel irregularia. Thyriothecia numerosa dense aggregata rotundata 100–160μ diam., saepe 2–plures–connata, atra; paries inferior hyalinus indistinctus; paries superior virideo-niger, ex hyphis radiantibus 5–7μ crassis, cellulis 5–10μ longis, compositus, margine haud fimbriatus, stellatim dehiscens. Asci aparaphysati numerosi globosi vel saccati, sessiles apice late rotundati, haud incrassati, 8–spori, 32–40 x 20–25μ. Sporae conglobatae atrobrunneae oblongae utrinque rotundatae, 1–septatae constrictae 18–22 x 10–11μ, cellulis subaequalibus subglobosis, episporio subtiliter granuloso-verruculoso. Pycnidia numerosa, thyriotheciis consimilia; pycnosporae subglobosae ellipsoideae vel piriformes, continuae 14–17 x 8–12μ, atrobrunneae, in medio zono subhyalino praeditae, leves.

Hab. in foliis *Brandisiae* sp., Kwangsi Province, Loh Hoh Tsuan, Ling Yuin Hsien, *Cheo 1824.*

Colonies epiphyllous, up to 1 mm. diam., inconspicuous black thin smooth, sometimes confluent. Mycelium of loosely reticulate dark brown hyphae 4–5μ thick, the cells mostly about 20μ long, the primary hyphae more or less straight, the others undulate to crooked; the mycelium becoming closely reticulate in the centre when the perithecia are developing; branching opposite or irregular. Hyphopodia continuous, alternate or unilateral, 5–8μ long, 6–11μ broad, 3–6-lobed with rather deep lobes, symmetrical or irregular. Thyriothecia numerous, closely crowded, 100–160μ diam., more or less circular, often 2–several-connate into large irregular compound ascomata, black to greenish black. Upper wall opaque green-black, composed of a single layer of radiating hyphae 5–7μ thick, the cells 5–10μ long, the margin crenate, not fimbriate; dehiscent by numerous stellate fissures extending to the margin, into narrowly triangular segments. Lower wall of thyriothecium hyaline, indistinct. Asci numerous, aparaphysate, globose to ellipsoid, sessile, broadly rounded at the apex, thin-walled, 8-spored 32–40 x 20–25μ. Spores conglobate dark brown, oblong with rounded ends, 1-septate, constricted 18–22 x 10–11μ, the cells more or less equal and subglobose; epispore finely granular-verruculose. Pycnidia numerous, scattered amongst the thyriothecia and closely resembling these, 80–110μ diam.; pycnospores subglobose, ellipsoid or piriform, continuous, 14–17 x 8–12μ, dark brown with subhyaline central transverse zone, smooth.

17. **Asterina Jasmini** sp. nov.

FIGURE 17

Plagulae epiphyllae atrae leves densa orbiculars usque ad 4 mm. diam., numerosae confluentes. Mycelium ex hyphis atrobrunneis flexuosis 4–5μ crassis, (cellulis

plerumque 15–20μ longis, irregulariter ramosis, dense reticulatis compositum. Hyphopodia alternata vel unilateralia, continua, subglobosa vel 3–5–lobata, 7–11 x 8–12μ. Thyriothecia dense dispersa, plerumque discreta, rotundata atra 100–160μ diam.; paries inferior ex hyphis laxe radiantibus virideo-hyalinis 4–5μ crassis compositus; paries superior convexus, opace atrobrunneus, ex hyphis radiantibus 4–5μ crassis, cellulis 5–10μ longis compositus, margine fimbriatus, hyphis fimbriarum tortuoso-radiantibus brunneis exhyphopodiatis usque ad 70μ longis, stellatim prope marginem dehiscens, partibus centralibus secedentibus. Asci numerosi, in ordine maturescentes, globosi aparaphysati sessiles tenuiter tunicati, 40–45μ diam. Sporae conglobatae atrobrunneae oblongae utrinque rotundatae, 1–septatae fortiter constrictae, 26–31 x 14–16μ, cellulis subaequalibus, episporio subtiliter granuloso.

Hab. in foliis *Jasmini* sp., Kwangsi Province, Loh Hoh Tsuen, Ling Yuin Hsien, 30.3.1933, *Cheo 1756*.

Colonies epiphyllous black smooth dense orbicular, up to 4 mm. diam., usually very numerous and confluent over the leaf. Mycelium of dark brown crooked hyphae 4–5μ thick, the cells mostly 15–20μ long, branching irregular, closely reticulate-interwoven. Hyphopodia continuous, alternate or unilateral, (many hyphae exhyphopodiate) subglobose to palmately 3–5-lobed, 7–11 x 8–12μ. Thyriothecia closely scattered, usually discrete, circular black 100–160μ diam.; basal wall of loosely radiating greenish hyaline hyphae 3μ thick; the upper wall convex, of opaque dark brown radiating hyphae 4–5μ thick, the cells 5–10μ long; margin fimbriate, the fringing hyphae tortuous radiating, paler than the mycelium, exhyphopodiate, up to 70μ long; dehiscence by stellate fissures almost to the margin, the central parts falling away and exposing the layer of asci. Asci aparaphysate numerous, ripening in succession, globose, sessile, thin-walled, 40–45μ diam. Spores conglobate, dark brown, oblong with rounded ends, 1-septate, deeply constricted, the surface finely granulose, 26–31 x 14–16μ. Pycnidia and pycnospores not seen.

18. **Asterina Linderae** sp. nov.

FIGURE 18

Plagulae epiphyllae atrae orbiculares usque ad 4 mm. diam., leves, subdensae. Mycelium ex hyphis atrobrunneis 3–4.5μ crassis, cellulis plerumque 20–25μ longis, opposite vel irregulariter ramosis, dense reticulatis compositum, hyphis primariis subrectis, ramis undulatis vel flexuosis et saepe exhyphopodiatis. Hyphopodia alternata, digitato-cylindracea apice rotundata, integra 8–12 x 5–6μ, continua. Thyriothecia dense dispersa, rotundata 100–170μ diam., atra saepe 2–3–connata; paries inferior ex hyphis hyalinis tortuoso-radiantibus 3–4μ crassis compositus; paries superior atrobrunneus, convexus, ex hyphis subopace brunneis radiantibus 4–5μ crassis, cellulis 4–10μ longis compositus, margine fimbriatus, hyphis fimbriarum tortuoso-radiantibus, usque ad 40μ longis, saepe laterale connatis, stellatim prope marginem dehiscens, partibus centralibus secedentibus. Asci numerosi, in ordine maturescentes, ovati vel globosi, sessiles, tenuiter tunicatae, aparaphysati, 25–30 x 20–25μ, 4–8–spori. Sporae conglobatae atrobrunneae oblongae utrinque rotundatae, 1–septatae constrictae 18–22 x 8–9μ, cellulis subaequalibus, episporio levi.

Hab. in foliis *Linderae* sp., Kweichow Province, Lai Ling, Chiang K'ou Hsien, Fan Ching Shan, 17.9.1931, *Cheo 519*.

Colonies epiphyllous black orbicular, up to 4 mm. diam., smooth rather dense. Mycelium of dark brown hyphae 3–4.5μ thick, the cells mostly 20–25μ long, branching opposite or irregular, closely reticulate; primary

hyphae substraight, the others undulate to crooked and often without hyphopodia. Hyphopodia alternate, digitate-cylindric with entire rounded apex, continuous, 8–12 x 5–6μ. Thyriothecia closely scattered, circular 100–170μ diam., black, often 2–3-connate into irregular compound ascomata; basal wall of hyaline tortuous-radiating hyphae 3–4μ thick; upper wall of dark brown subopaque radiating hyphae 4–5μ thick, the cells 4–10μ long, margin fimbriate, the fringing hyphae tortuous-radiating, up to 40μ long, more or less laterally connate into irregular sheets; dehiscence by few radiate fissures to the margin into broadly triangular segments, the central parts falling away and the remainder of the upper wall becoming more or less erect around the exposed layer of asci. Asci numerous, ripening in succession, ovate to globose, sessile, thin-walled, aparaphysate 25–30 x 20–25μ, 4–8-spored. Spores conglobate, dark brown, oblong with rounded ends, 1-septate constricted, 18–22 x 8–9μ, the cells equal; surface smooth.

19. **Eriomycopsis chinensis** sp. nov.

Mycelium ex hyphis hyalinis dense reticulatis circa hyphas *Asterinae*, 2–3μ crassis, septatis, irregulariter ramosis. Conidiophora erecta, dispersa vel 2–3–fasciculata deorsum brunnea, superne pallidiora vel hyalina, subrecta vel superne leniter geniculata, 2–3–septata, simplices, 100–150 x 4–5μ, prope apicem sterigmata hyalina recta cylindracea 6–7 x 1μ praedita. Conidia singula elongato-fusoidea hyalina recta vel curvula 2–3–septata haud constricta levia 29–42 x 4–5μ, apice acute rotundata, basi truncata, hilo plano 1μ diam. et 1μ cr. praedita.

Hab. in mycelio *Asterinae Linderae*, in foliis *Linderae* sp., Kweichow Province, Lao Ling, Chiang K'ou Hsien, Fan Ching Shan, 17.9.1931, *Cheo 519 p.p.*

Mycelium hyaline closely reticulate over and between the hyphae of the *Asterina* host, the hyphae 2–3μ thick, irregularly branched, septate. Conidiophores scattered or 2–3-aggregate, dark brown in lower part, paler to subhyaline near the apex, erect, more or less straight below, bent and sometimes somewhat geniculate in upper part, 2–3-septate, simple, 100–150 x 4–5μ. The two distal cells bear 2–8 closely and irregularly scattered sterigmata, hyaline straight cylindric, apparently hollow, 6–7 x 1μ; sometimes one or two similar sterigmata occur lower down. Conidia formed singly on the ends of the sterigmata, hyaline, elongate straight or bent fusoid, smooth, thin-walled, 2–3-septate, not constricted, 29–42 x 4–5μ; apex acutely rounded, base 1μ thick and truncate.

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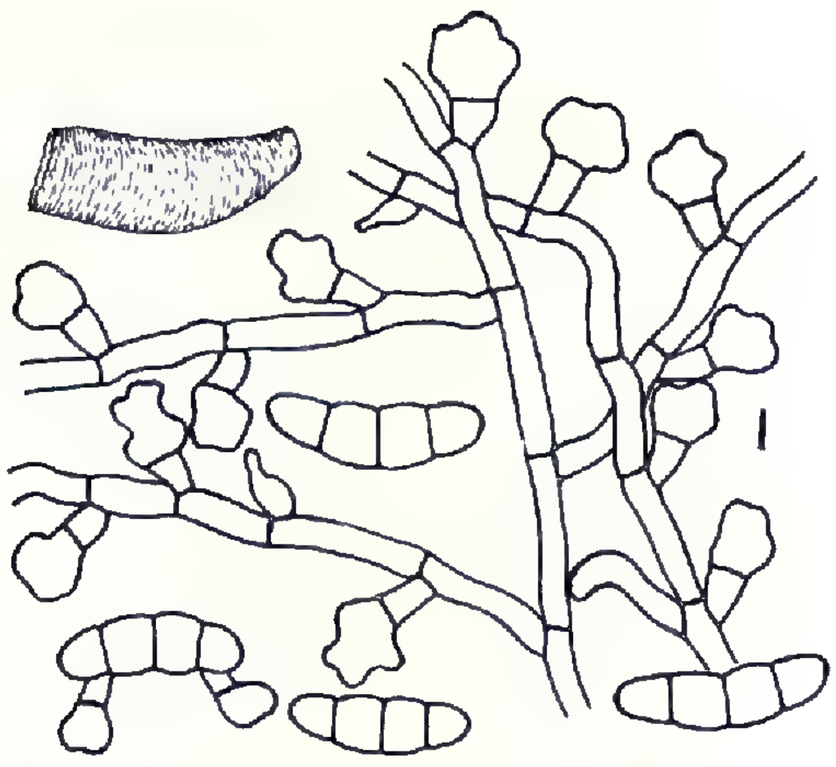
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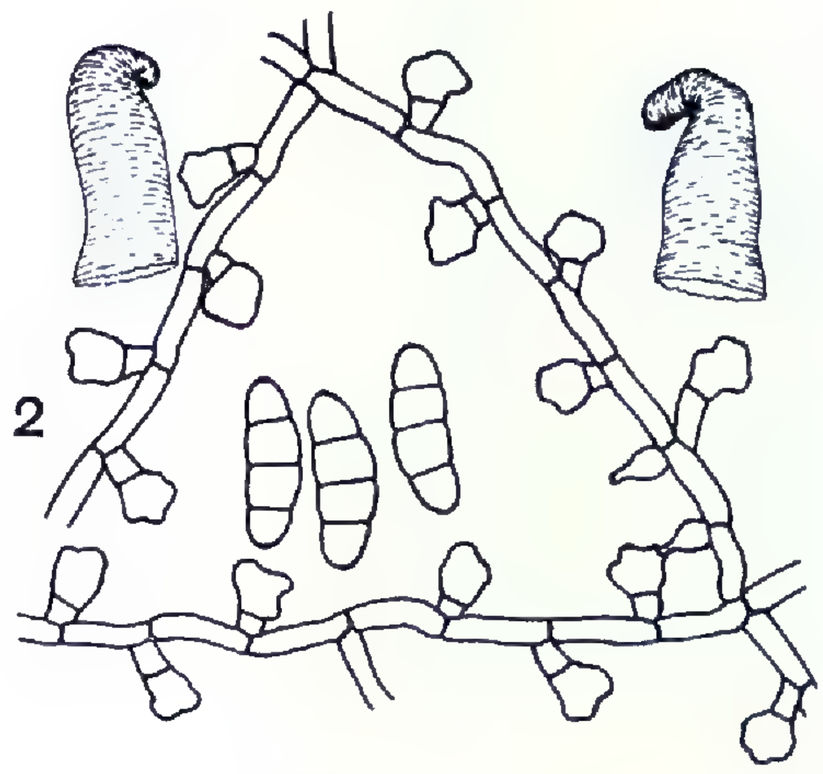
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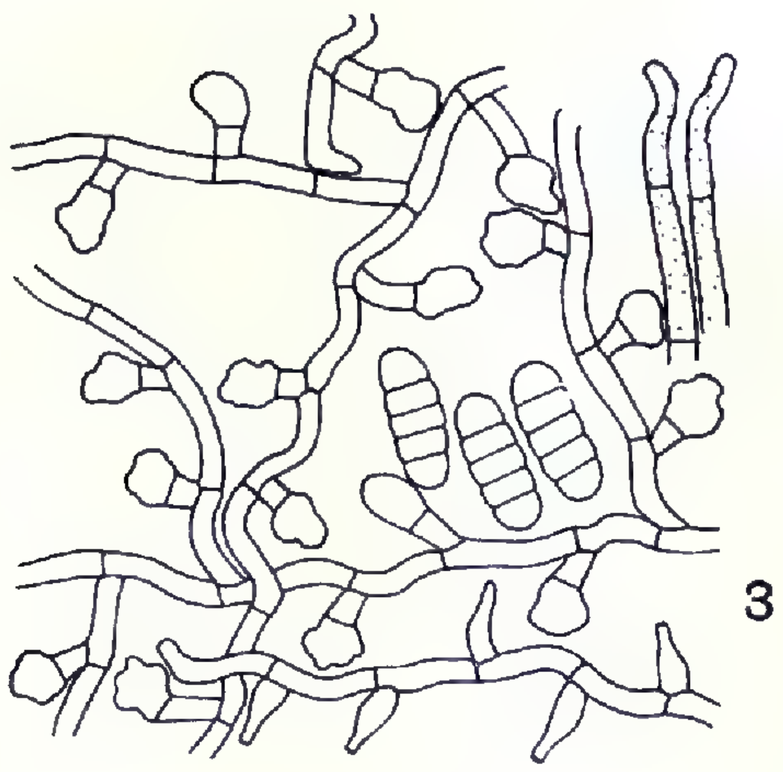
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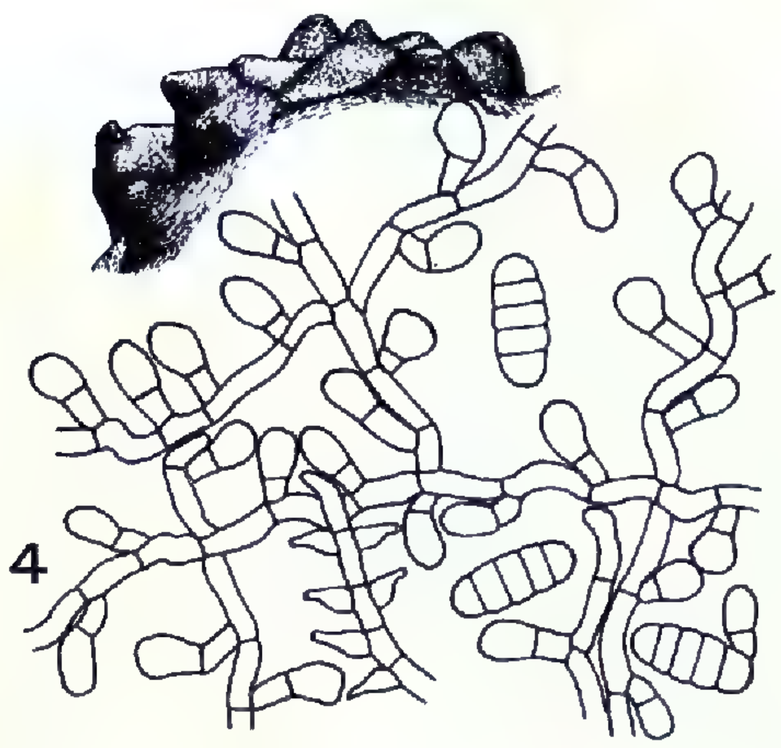
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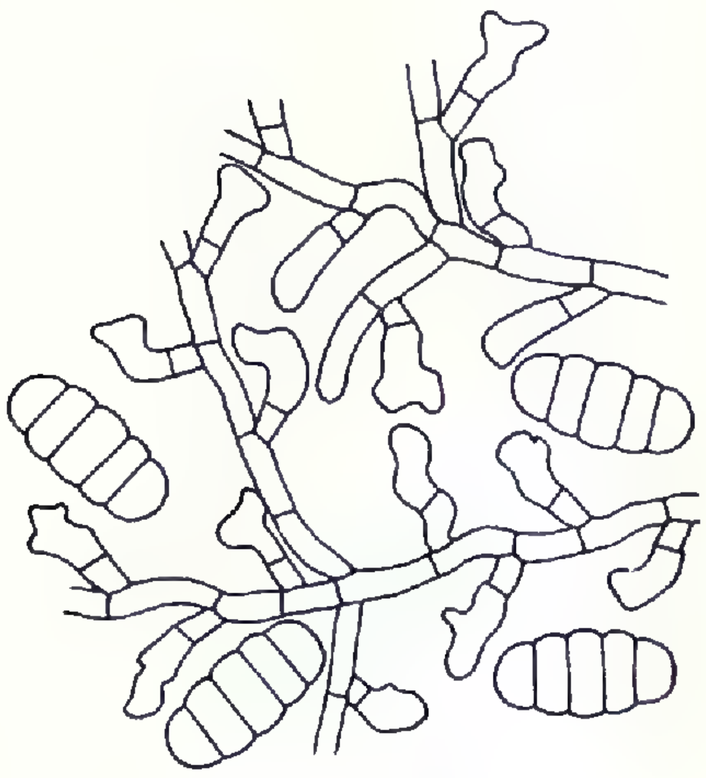
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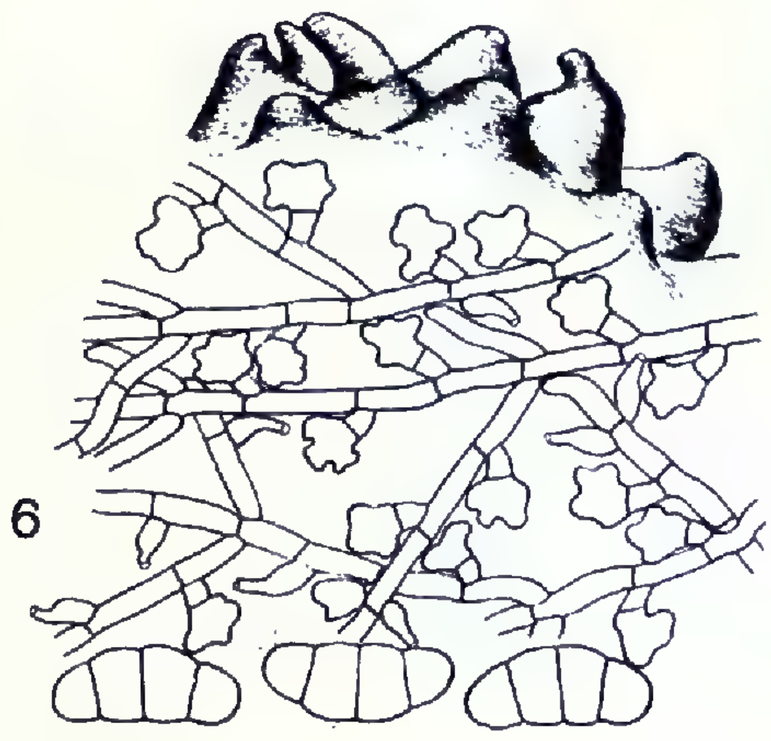
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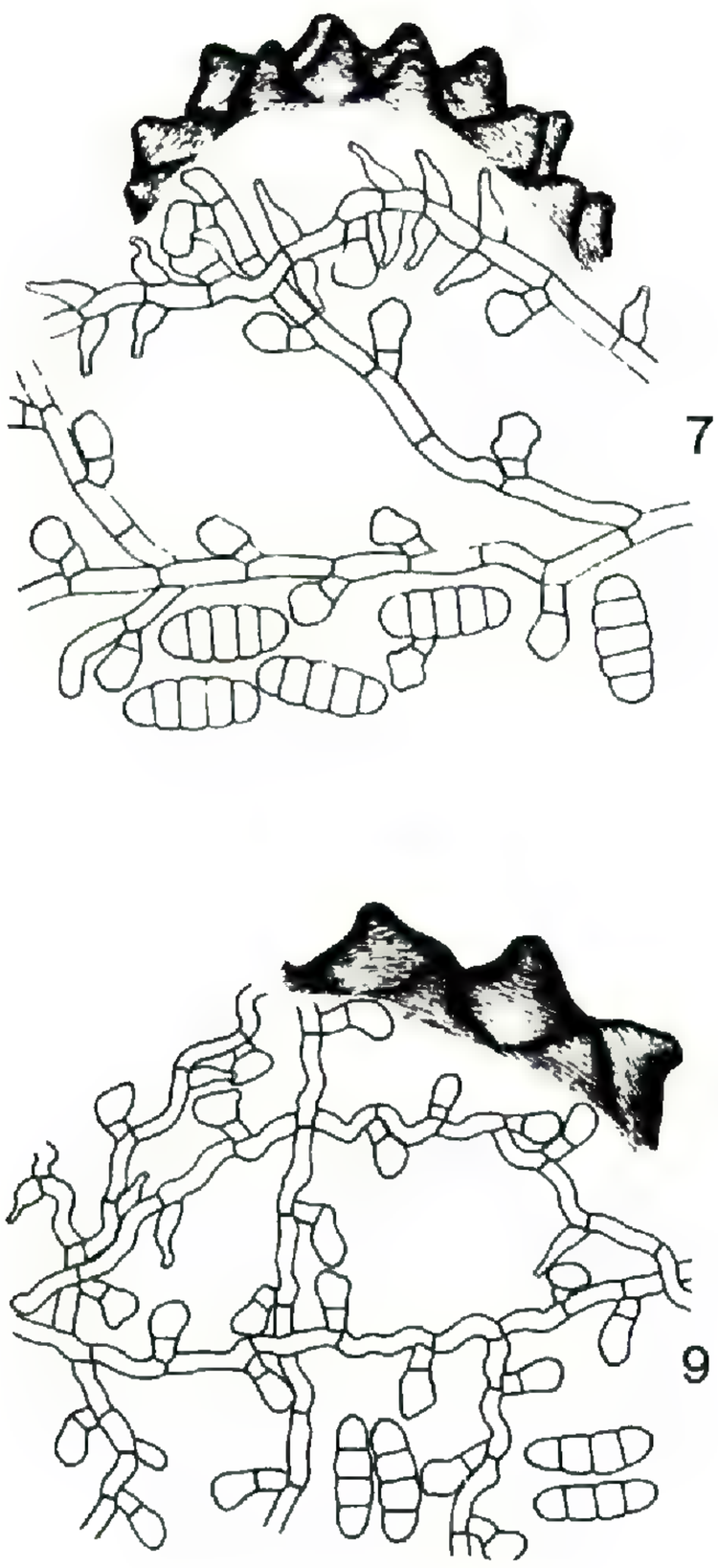
Fig. 1–6. All outlines × 250. **1,** *Irene calostroma.* **2,** *Irene styracicola* var. *minor.* **3,** *Irenopsis benguetensis.* **4,** *Irenina Buddleiae.* **5,** *I. Castanopsidis.* **6,** *I. Cheoi.*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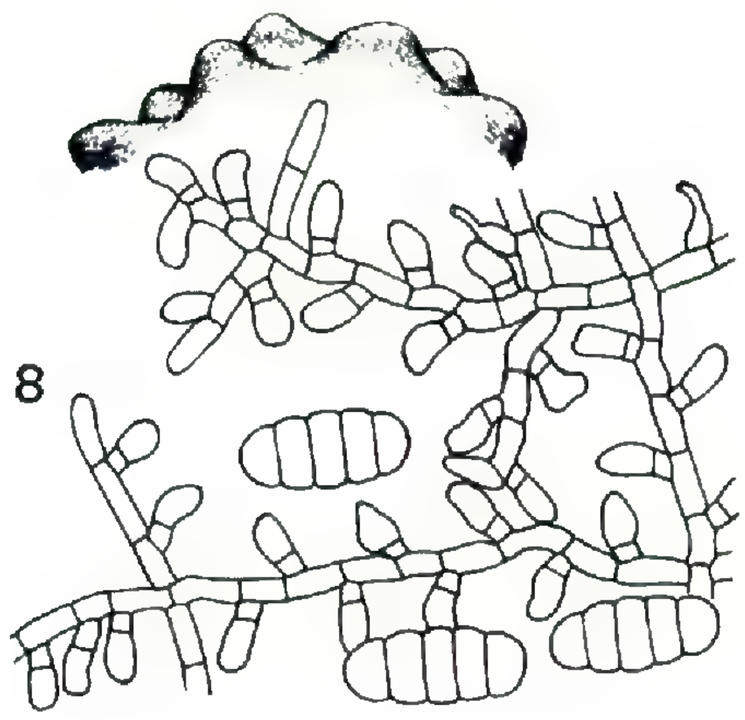
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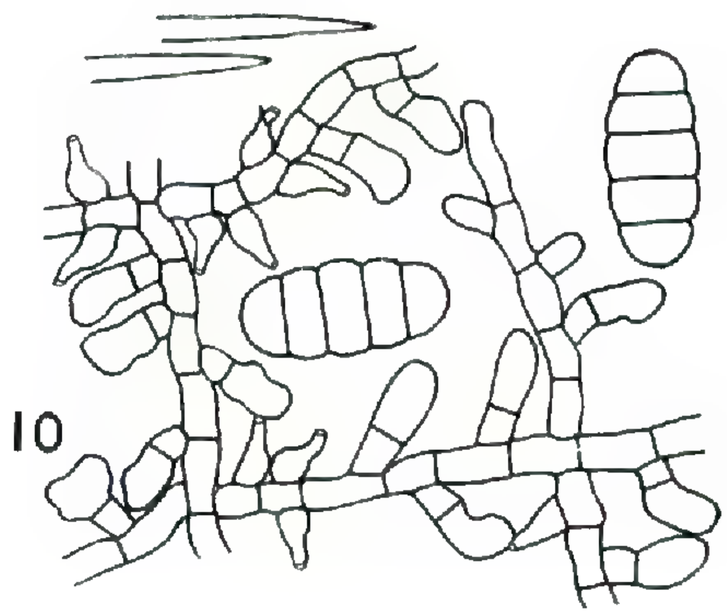
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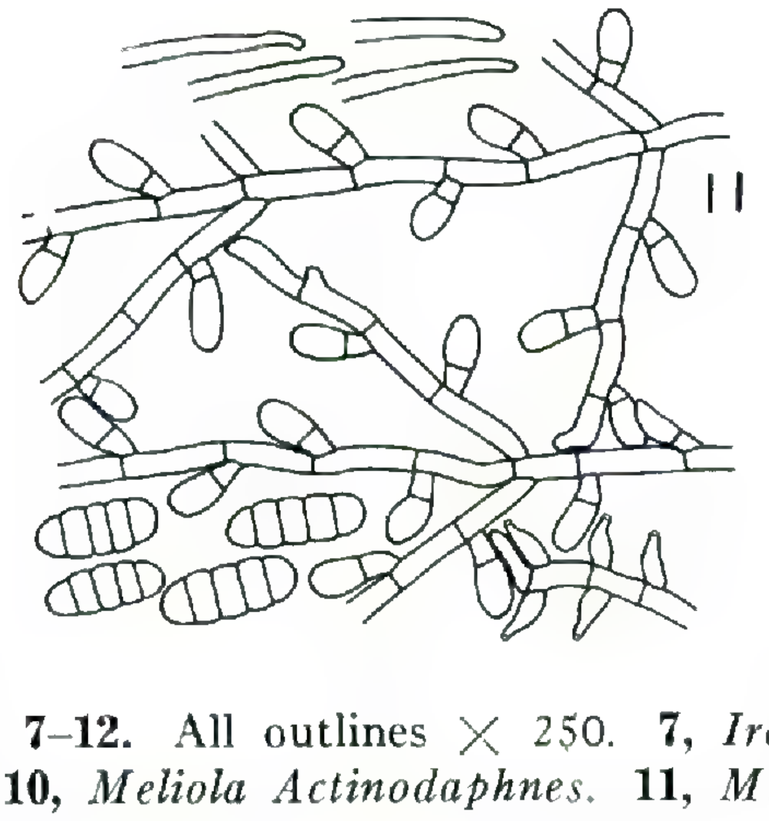
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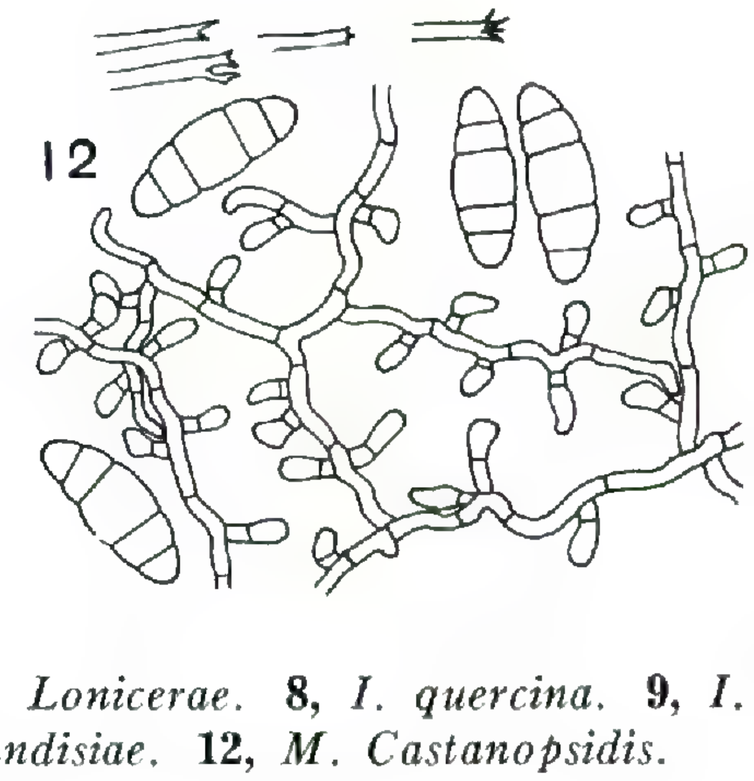
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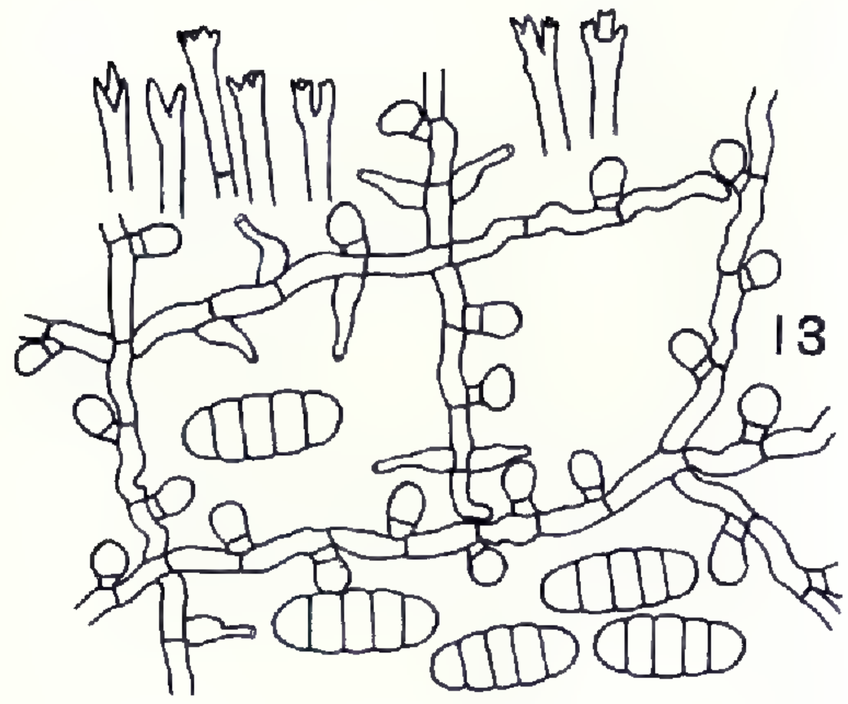
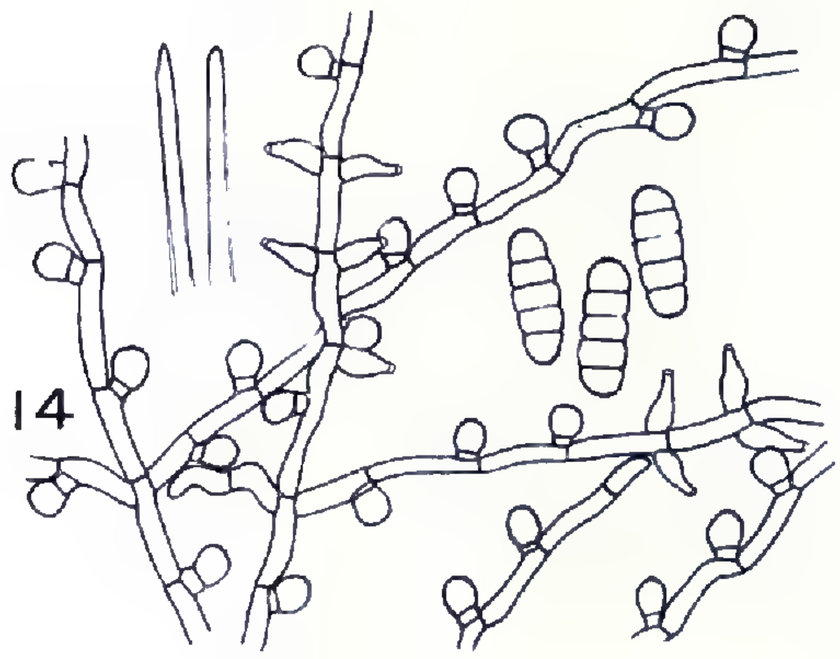
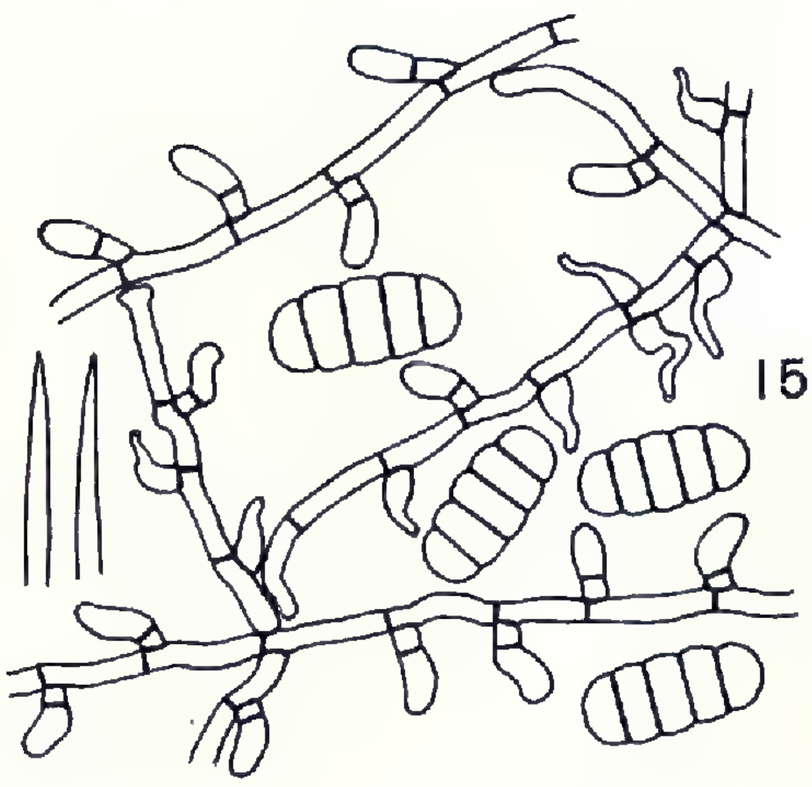
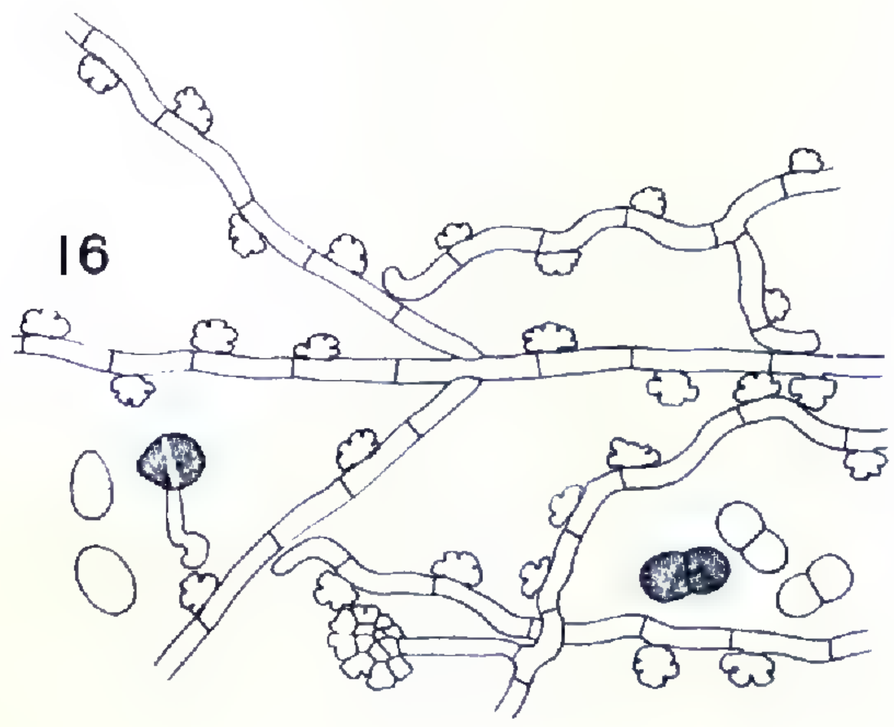
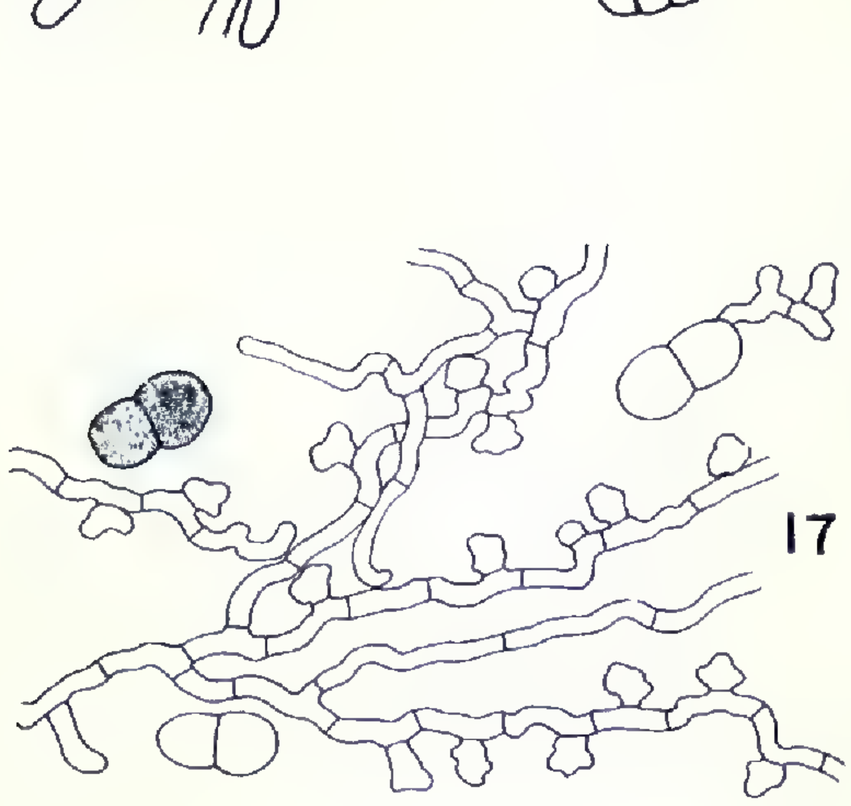
Fig. 7–12. All outlines × 250. **7,** *Irenina Lonicerae.* **8,** *I. quercina.* **9,** *I. Rosae.* **10,** *Meliola Actinodaphnes.* **11,** *M. Brandisiae.* **12,** *M. Castanopsidis.*











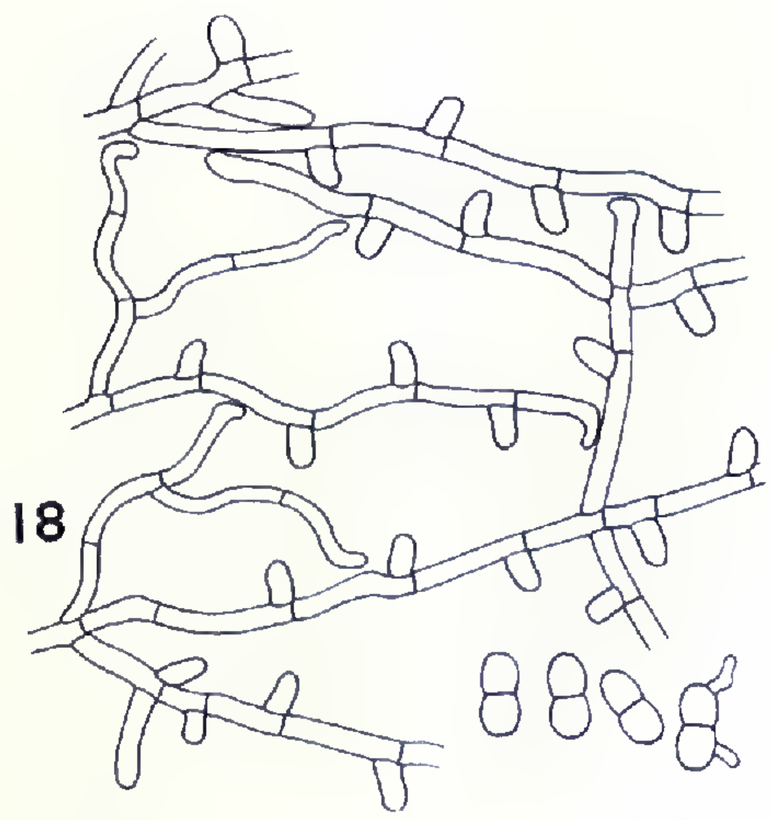


Fig. 13–18. All × 250. **13,** *Meliola Koelreuteriae.* **14,** *M. kweichowensis.* **15,** *M. symplocicola* var. *chinensis.* **16,** *Asterina Brandisiae.* **17,** *A. Jasmini.* **18,** *A. Linderae.*

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BY

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The fungi enumerated below have been collected during recent years in various parts of South India by the junior author and in most instances represent either new species or new records for India.

1. **Dictyonella Alangii** sp. nov.

FIGURE 1

Coloniae hypophyllae effusae tenues brunneae. Mycelium ex hyphis brunneis rectis septatis 3–4μ crassis exhyphopodiatis irregulariter ramosis laxe reticulatis compositum. Ascomata laxe dispersa, primo obconica, demum discoidea, usque ad 400μ diam. et circa 100μ alt., superficialia rufo-brunnea vel atro-brunnea, hyphis ferrugineis intertextis 2–5μ crassis vestita. Asci numerosi aparaphysati, laxe unistratosi, subglobosi nodoso-stipitati, 30–40 x 25–30μ, 8–spori, crasse tunicati (1–1.5μ). Sporae multiseriatae vel fere conglobatae, oblongae utrinque rotundatae, atrobrunneae leves transverse 5–septatae, in medio leniter constrictae, parte superiore leniter crassiore, cellulis pluribus longitudinaliter 1–septatis, 19–24 x 9–11μ. Conidiophora laxe dispersa, erecta atrobrunnea recta septata, usque ad 120 x 5μ, apice dense furcata, ramulis et conidiis capitulum globosum efformantibus. Conidia globosa brunnea levia continua 2μ diam., an catenulata ?.

Hab. in foliis *Alangii begoniifolii*, Thirthahalli, Mysore, 3.4.1945, *Thirumalachar 881*.

The colonies are always hypophyllous, widely effuse over the leaf, thin and brownish. The mycelium consists of straight brown septate hyphae 3–4μ thick, exhyphopodiate, irregularly and loosely branched, forming dark mycelial knots at the apices of the unicellular leaf hairs, on which the fungus appears to be parasitic. There is also a fine, much branched, hyaline mycelium within the mesophyll, and emergent through a few stomata, but definite connection between this and the external hyphae could not be established, though both kinds of hyphae ramify amongst the leaf hairs. The ascomata are entirely superficial on the external mycelium, and easily detached from the host leaf; at first obconic and clothed with a layer of ferruginous interwoven loose hyphae 2–5μ thick and septate into short cells, with the terminal cells somewhat swollen and subglobose. Towards the base of the ascoma this external hyphal layer is more compact and pseudoparenchymatous, with the hyphae of the mycelium radiating outwards from it. The ascomata as they mature become flattened discoid, up to 400μ diam. and about 10μ high, covered around the edge with the remains of the original ferruginous hyphae, with the centre darker and almost black when the spores have matured. The asci are in a loose single layer, and apparently separated by remains of the stroma tissue, without true paraphyses, numerous, globose with a very short nodose foot, thick-walled (1–1.5μ) 8-spored, 30–40 x 25–30μ. Spores almost con-

globate, oblong with rounded ends, subopaque dark brown, transversely 5-septate and with the larger cells longitudinally 1-septate, slightly constricted at the middle septum and with the upper half slightly wider than the lower; whole spores 19–24 x 9–11μ.

The conidiophores are of *Periconia* type, loosely scattered over the mycelium, each arising from a swollen foot cell which is usually lateral on the parent hypha, erect, dark brown, straight, septate, up to 120 x 5μ, the apex divided into a number of very short close branches, which together with the conidia form a small terminal globose head. Conidia possibly catenulate from the tips of the branches of the conidiophore, globose, brown, continuous, smooth, 2μ diam.

Though this fungus lacks the typically more or less spongy-glebose structure of Myriangiaceae, it does not possess a true parenchymatous wall around the ascoma, nor is a definite ostiole present; the spores are of a type very common in this family.

2. **Armatella Litseae** (P. Henn.) Theiss. & Sydow in Ann. Mycol. **13:** 235.1915.

FIGURE 2

On *Neolitsea zeylanica*, Nandi, Mysore, *Thirumalachar 901 p.p.*

Colonies epiphyllous black rounded, usually discrete, thin to sub-dense, up to 8 mm. diam. Mycelium of straight to finely wavy dark brown hyphae 5–7μ thick, the cells mostly 15–30μ long, branching regularly alternate, rather closely reticulate. Capitate hyphopodia alternate only, at wide angles, 15–22μ long, stalk cell short cylindric 2–5μ long, head cell irregularly stellate with numerous lobes, 8–15 x 10–15μ. Mucronate hyphopodia none. Mycelial setae none. Perithecia loosely scattered, black, globose, up to 180μ diam., the surface cells bluntly conoid or rounded, somewhat projecting. Spores oblong with rounded ends, 1-septate constricted smooth 37–42 x 12–15μ; at germination the upper cell much darker than the lower, which finally collapses while a hyphopodium is formed by an apical outgrowth. Each perithecium is surrounded by a fringe of tortuous-radiating pale brown exhyphopodiate hyphae up to 100μ long.

3. **Armatella Cinnamomi** sp. nov.

FIGURE 3

Plagulae hypophyllae tenues effusae irregulares atrae confluentes. Mycelium ex hyphis atrobrunneis sinuosis vel undulatis, 4–5μ crassis (cellulis plerumque 20–30μ longis) irregulariter ramosis, laxe reticulatis compositum. Hyphopodia capitata alternata vel unilateralia 10–20μ longa, cellula basali cylindracea 2–6μ longa, cellula apicali globosa, cylindracea vel uncinata, interdum sub–2–lobata, 6–15 x 5–10μ. Hyphopodia mucronata nulla. Setae nullae. Perithecia laxe dispersa, discreta atra globosa verrucosa, usque ad 140μ diam., cellulis parietis obtuse conoideis prominentibus. Asci non visi. Sporae oblongae utrinque rotundatae, dilute brunneae, 1–septatae, constrictae leves 20–22 x 9–11μ, cellula superiore leniter crassiore.

Hab. in foliis *Cinnamomi zeylanici*, Balehonnur, Mysore, 27.4.1945, *Thirumalachar 886*.

Colonies hypophyllous thin, effuse and covering most of the leaf, confluent, irregular, black. Mycelium of dark brown crooked to undulate hyphae 4–5μ thick, the cells 20–30μ long, branching irregular, loosely

reticulate. Capitate hyphopodia alternate or unilateral, usually one to each cell, formed some distance behind the septum of the parent cell, 10–20μ long; stalk cell cylindric 2–6μ long; head cell globose, cylindric or boot-shaped, sometimes sub-2-lobate, 6–15 x 5–10μ. Mucronate hyphopodia none. Setae none. Perithecia loosely scattered single black globose verrucose, up to 140μ diam., the surface cells bluntly conic, projecting; wall not radiate but truly parenchymatous; each perithecium surrounded at the base with an areole of radiating hyphopodiate hyphae and easily detached from the leaf, leaving this areole and hence closely resembling an *Asterina*. Asci not seen. Spores oblong with rounded ends, pale brown 1-septate constricted smooth, 20–22 x 9–11μ, the upper cell slightly larger than the lower. At germination the upper cell becomes darker brown, while the lower cell collapses; from the upper a hyphopodium grows out.

4. **Amazonia Leeae** sp. nov.

FIGURE 4

Plagulae amphigenae plerumque epiphyllae, dispersae atrae orbiculares leves densae, tenuiter crustosae, usque ad 1 mm. diam. Mycelium ex hyphis atrobrunneis undulatis 7–9μ crassis (cellulis plerumque 10–15μ longis) alternatim vel irregulariter ramosis, densissime reticulatis compositum. Hyphopodia capitata alternata antrorsa subrecta 12–16μ longa, cellula basali cylindracea 3–5μ longa, cellula apicali globosa integra 10–12μ diam. Hyphopodia mucronata non visa. Setae nullae. Perithecia depresso-globosa atra, usque ad 260μ diam., sursum hyphis mycelii radiantibus vestita, irregulariter dehiscentia. Sporae atrobrunneae subellipsoideae utrinque rotundatae, 4–septatae constrictae 39–45 x 17–21μ.

Hab. in foliis *Leeae macrophyllae*, Balehonnur, Mysore, 29.4.1945, *Thirumalachar 867*.

Colonies mostly epiphyllous, scattered, black, orbicular smooth dense, thinly crustose, up to 1 mm. diam. Mycelium of radiating dark brown undulating hyphae 7–9μ thick, the cells mostly 10–15μ long, branching alternate or unilateral, forming almost a solid plate of hyphae and hyphopodia. Capitate hyphopodia alternate, antrorse, usually straight, 12–16μ long; head cell globose, entire, 10–12μ diam.; stalk cell cylindric 3–5μ long. Mucronate hyphopodia not seen; setae none. Perithecia flattened globose with a radiate upper wall of mycelial hyphae, up to 260μ diam., black, opaque, irregularly dehiscent in the centre. Spores dark brown, ellipsoid with rounded ends, 4-septate, constricted, 39–45 x 17–21μ.

5. **Irenopsis mysorensis** sp. nov.

FIGURE 5

Plagulae epiphyllae, raro etiam hypophyllae, atrae orbiculares densae numerosae, dense dispersae, usque ad 1 mm. diam. Mycelium ex hyphis atrobrunneis subrectis vel undulatis, 6–7μ crassis (cellulis plerumque 20–25μ longis) opposite ramosis (45–90°) dense reticulatis compositum. Hyphopodia capitata alternata, plerumque recta, 15–22μ longa, cellula basali cylindracea 4–9μ longa, cellula apicali globosa vel late clavata, integra vel raro subangulosa, 10–15 x 10–14μ. Hyphopodia mucronata pauca, dispersa, opposita vel alternata, ampullacea vel obtuse conoidea, plus minusve curvata, 15–21 x 6–8μ, collo 3–4μ crasso. Setae myceliales nullae. Perithecia in centro plagularum aggregata, atra globosa verrucosa 150–210μ diam., cellulis parietis obtuse

conoideis; setae perithecíales 0–5, erecto-divergentes, atrobrunneae simplices obtusae leves 0–1–septatae, irregulariter curvatae, haud hamatae, usque ad 60 x 6–7μ. Sporae atrobrunneae cylindraceae vel subellipsoideae utrinque rotundatae, 4–septatae constrictae 38–45 x 14–18μ.

Hab. in foliis *Lasiosiphonis ericocephali*, Ranjadakatte, Thirthahalli, Mysore, 4.4.1945, *Thirumalachar 873*.

Colonies epiphyllous, rarely hypophyllous, black orbicular dense smooth numerous, closely scattered, up to 1 mm. diam. Mycelium of substraight to undulate dark brown hyphae 6–7μ thick, the cells mostly 20–25μ long, branching usually opposite at 45–90°, closely reticulate. Capitate hyphopodia alternate, usually straight, 15–22μ long; head cell globose to widely clavate, entire or rarely subangulose, 10–15 x 10–14μ; stalk cell cylindric 4–9μ long. Mucronate hyphopodia few, scattered, opposite, alternate or solitary, ampulliform to blunt conoid, bent, 15–21 x 6–8μ, neck 3–4μ thick. Mycelial setae none. Perithecia in a close central group, black, globose, verrucose, 150–210μ diam., the surface cells bluntly conoid; perithecial setae 0–5 erect-divergent, dark brown, simple, obtuse, irregularly bent but not hamate or coiled, smooth, up to 60μ long by 6–7μ thick, 0–1-septate, arising from the sides and upper half of the perithecial wall. Spores cylindric to subellipsoid with rounded ends, dark brown 4-septate, constricted, 38–45 x 14–18μ (average 42 x 16μ).

6. **Irenina Pothodis** sp. nov.

FIGURE 6

Plagulae amphigenae plerumque epiphyllae, usque ad 2 mm. diam., leves orbiculares atrae densae, dense dispersae. Mycelium ex hyphis subrectis vel sinuosis atrobrunneis 8–9μ crassis (cellulis plerumque 25–30μ longis) opposite ramosis (45–90°) dense reticulatis compositum. Hyphopodia capitata alternata antrorsa recta vel curvata, 15–25μ longa, cellula basali cylindracea vel cuneata 4–10μ longa, cellula apicali globosa ovata clavata vel angulosa, recta vel curvula, 10–14 x 8–10μ. Hyphopodia mucronata pauca dispersa, opposita vel alternata, ampullacea 13–20 x 8–10μ, collo brevi 3–4μ crasso. Setae myceliales nullae. Perithecia dense dispersa, atra globosa usque ad 190μ diam., cellulis parietis obtuse conoideis aegre prominentibus. Sporae atrobrunneae, cylindraceae vel subellipsoideae utrinque rotundatae, 4–septatae constrictae 38–46 x 15–18μ.

Hab. in foliis *Pothodis scandentis*, Thirthahalli, Mysore, 4.4.1945, *Thirumalachar 879*.

Colonies amphigenous, mostly epiphyllous, up to 2 mm. diam., smooth, orbicular, black, subdense, closely scattered. Mycelium of substraight to crooked dark brown hyphae 8–9μ thick, the cells mostly 25–30μ long, branching usually opposite at 45–90°, closely reticulate. Capitate hyphopodia alternate, antrorse, straight or bent, 15–25μ long; head cell globose, ovate, clavate or angulose, straight or bent, 10–14 x 10–13μ; stalk cell 4–10μ long. Mucronate hyphopodia few, scattered, opposite or alternate ampulliform, 13–20 x 8–10μ neck short 3–4μ thick. Mycelial setae none. Perithecia closely scattered, black, globose, up to 190μ diam., the surface cells bluntly conoid, scarcely projecting. Spores dark brown, cylindric to subellipsoid with rounded ends, 4-septate, constricted, 38–46 x 15–18μ (average 43 x 16.5μ).

7. **Irenina Malloti** sp. nov.

FIGURE 7

Plagulae hypophyllae, in tomento folii absconditae, usque ad 4 mm. diam., vel confluentes. Mycelium ex hyphis atrobrunneis sinuosis 6–7μ crassis (cellulis plerumque 20–35μ longis) irregulariter ramosis, laxe reticulatis compositum. Hyphopodia capitata alternata recta vel curvata, 14–29μ longa, cellula basali cylindracea 5–10μ longa, cellula apicali clavata vel irregulariter rotundato-angulosa raro sublobata 10–20 x 11–16μ. Hyphopodia mucronata dispersa, alternata vel unilateralia, curvata, conoidea vel ampullacea 17–22 x 7–10μ, collo 4–5μ crasso. Perithecia dispersa atra globosa 150–210μ diam., cellulis parietis mammillatibus usque ad 35μ alt. Sporae subellipsoideae utrinque rotundatae atrobrunneae 4-septatae constrictae 49–57 x 19–24μ.

Hab. in foliis *Malloti albae*, Balehonnur, Mysore, 28.9.1944, *Thirumalachar*.

Colonies hypophyllous, hidden amongst the dense tomentum of the leaf with only the perithecia showing, up to 4 mm. diam., or more or less confluent. Mycelium of crooked dark brown hyphae 6–7μ thick, the cells mostly 20–35μ long, irregularly branched, loosely reticulate and interwoven amongst the leafhairs. Capitate hyphopodia alternate only, at wide angles, straight or bent, 14–29μ long; stalk cell cylindric 5–10μ long; head cell clavate or irregularly rounded-angulose, occasionally sublobate, 10–20 x 11–16μ. Mucronate hyphopodia scattered, alternate or unilateral, bent conoid-ampulliform with rather wide neck (4–5μ), 17–22 x 7–10μ, occasionally also opposite. Perithecia closely scattered, black, globose, 150–210μ diam., the surface cells mammillate with bent conoid obtuse processes up to 35μ high, about 40μ diam. at the base, often simulating the "larviform appendages" of *Irene* spp., but distinguished in being opaque dark brown and never septate. Spores subellipsoid with rounded ends, dark brown, 4-septate, constricted 49–57 x 19–24μ (average 53.3 x 21.3μ).

8. **Meliola Bakeri** Syd. in Ann. Mycol. **14:** 355. 1916.

FIGURE 8

On *Leea* sp., Kudumallige, Thirthahalli, Mysore, 3.4.1945, *Thirumalachar 857*; on *L. macrophylla*, Balehonnur, Mysore, *Thirumalachar 867*.

Colonies amphigenous, mostly epiphyllous, black, orbicular to irregular, up to 5 mm. diam. or confluent over the leaf, thin to subdense, velvety. Mycelium of crooked to undulate dark brown hyphae 6–8μ thick, the cells mostly 20–25μ long, branching opposite at 45–90°, closely reticulate in some colonies and on *No. 867*, thinner on *No. 857*. Capitate hyphopodia alternate or 1–5% opposite, straight or bent, 13–25μ long; head cell cylindric-clavate to angulose or sometimes irregularly 2–3-sublobed, 10–17 x 9–14μ; stalk cell cylindric 5–10μ long. Mucronate hyphopodia on separate branches of the mycelium, few, usually opposite, bent ampulliform, 16–20 x 6–8μ, with rather long neck 2–3μ thick. Mycelial setae numerous, scattered, erect, straight, simple, acute to subacute, 260–400 x 7–10μ. Perithecia scattered, black, globose, verrucose, 120–150μ. Spores dark brown, cylindric with rounded ends, 4-septate, slightly constricted, 33–42 x 12–15μ (average 37 x 14μ).

This is very close to Philippine collections on *Tetrastigma*, the type host, according to collections in Herb. Pretoria.

9. **Meliola bangalorensis** sp. nov.

FIGURE 9

Plagulae amphigenae densae atrae velutinae orbiculares, usque ad 5 mm. diam., in epiphyllo saepe numerosae et late confluentes. Mycelium ex hyphis atrobrunneis sinuosis vel subrectis 7–9μ crassis (cellulis plerumque 15–40μ longis) opposite ramosis (45–90°) dense reticulatis compositum. Hyphopodia capitata alternata (rarissime etiam opposita) recta vel curvata, leniter antrorsa, 15–23μ longa, cellula basali cylindracea 4–9μ longa, cellula apicali subglobosa vel clavata, recta vel curvata, integra vel irregulariter angulosa (in hypophyllo saepe sub-2–3-lobata) 10–16 x 10–15μ. Hyphopodia mucronata modice numerosa, in hyphis distinctis evoluta, opposita, alternata, solitaria vel ternata, ampullacea 15–20 x 7–9μ, plus minusve curvata, collo 2–2.5μ crasso. Setae myceliales numerosae erectae rectae simplices acutae opacae 200–260 x 8–10μ, dense dispersae etiam circum perithecia aggregatae. Perithecia dense dispersa atra globosa verrucosa, usque ad 160μ diam. Sporae atrobrunneae cylindraceae utrinque rotundatae 4-septatae constrictae 33–40 x 13–15μ.

Hab. in foliis *Fici* sp., Bannerguatta, Bangalore, Mysore, 14.8.1945, *Thirumalachar 884*.

Colonies amphigenous, dense, black, velvety, orbicular to 5 mm. diam., or on the upper side of the leaf often numerous and widely confluent. Mycelium of substraight to crooked dark brown hyphae 7–9μ thick, the cells 15–40μ long, branching opposite at 45–90°, closely reticulate (the hyphae more crooked in hypophyllous colonies). Capitate hyphopodia alternate, very rarely opposite, straight or bent, usually at wide angles 15–23μ long; head cell subglobose to clavate, straight or bent, entire or especially in the hypophyllous colonies often irregularly angulose to sub-2–3-lobed, 10–16 x 10–15μ; stalk cell 4–9μ long. Mucronate hyphopodia fairly numerous, on separate hyphae, opposite, alternate, solitary or ternate, ampulliform, 15–20 x 7–9μ, more or less bent; the neck 2–2.5μ thick. Mycelial setae numerous, thickly scattered over the mycelium and also grouped around the perithecia, erect straight simple acute, opaque black, 200–260 x 8–10μ. Perithecia closely scattered, black globose verrucose, up to 160μ diam. Spores dark brown, cylindric with rounded ends, 4-septate, constricted 33–40 x 13–15μ (average 36 x 14μ).

10. **Meliola Cansjerae** sp. nov.

FIGURE 10

Plagulae amphigenae orbiculares atrae densae velutinae subcrustosae usque ad 3 mm. diam., vel numerosae confluentesque. Mycelium ex hyphis atrobrunneis subrectis 7–8μ crassis (cellulis plerumque 15–30μ longis) opposite ramosis (30–60°) dense reticulatis, compositum, in centro plagularum subsolidum. Hyphopodia capitata alternata vel usque ad 15 % opposita, antrorse curvata, 13–25μ longa, cellula basali cylindracea 3–8μ longa, cellula apicali ovata clavata vel cylindracea, integra, apice rotundata, recta vel curvata, 10–17 x 8–11μ. Hyphopodia mucronata pauca dispersa, opposita vel alternata, ampullacea 20–25 x 7–9μ, collo curvato 3–4μ crasso. Setae myceliales numerosissimae erectae rigidae rectae atrae opacae 200–280 x 9–10μ, apice raro simplices acutae, plerumque 2–3-dentatae vel furcatae (-30μ) ramulis dentatis. Perithecia in centro plagularum aggregata, atra globosa verruculosa, usque ad 195μ diam. Sporae atrobrunneae cylindraceae utrinque rotundatae 4-septatae constrictae 39–47 x 15–18μ.

Hab. in foliis *Cansjerae Rheedii*, Nandi Hills, Mysore, 25.3.1945, *Thirumalachar*.

Colonies amphigenous orbicular dense black velvety subcrustose, up to

3 mm. diam., or numerous and subconfluent. Mycelium of substraight dark brown hyphae 7–8μ thick, the cells mostly 15–30μ long, branching opposite at 30–60°, densely reticulate and becoming almost solid in the centre of each colony. Capitate hyphopodia alternate or up to 15% opposite, antrorse bent, 13–25μ long; head cell ovate, clavate or cylindric, entire, rounded at the apex, straight or bent, 10–17 x 8–11μ; stalk cell cylindric 3–8μ long. Mucronate hyphopodia rather few, scattered amongst the capitate, opposite or alternate, ampulliform 20–25 x 7x9μ, neck more or less bent, 3–4μ thick. Mycelial setae very numerous, closely scattered, erect, stiff, straight, black, opaque 200–280 x 9–10μ, apex rarely simple and acute, mostly 2–3-dentate or furcate to 30μ, the branches denticulate. Perithecia in a central group, black, globose verruculose, up to 195μ diam. Spores dark brown, cylindric with rounded ends, 4-septate, constricted 39–47 x 15–18μ (average 43 x 16μ).

This species is rather close to *M. Opiliae* Syd. but differs in its large proportion of alternate capitate hyphopodia.

11. **Meliola cissampelicola** sp. nov.

FIGURE 11

Plagulae amphigenae plerumque epiphyllae, atrae, orbiculares vel irregulares, saepe numerosae confluentesque, usque ad 1 mm. diam. Mycelium ex hyphis atrobrunneis undulatis 6–8μ crassis (cellulis plerumque 20-35μ longis) opposite vel irregulariter ramosis (45–90°) laxe reticulatis compositum. Hyphopodia capitata alternata plus minusve antrorsa, recta vel curvata 20–30μ longa, cellula basali cylindracea vel cuneata 4–11μ longa, cellula apicali ovata vel clavata, integra 13–20 x 9–13μ. Hyphopodia mucronata in hyphis distinctis evoluta, opposita vel plerumque alternata vel unilateralia, ampullacea 14–23 x 6–8μ, colo 4μ crasso. Setae myceliales tenuiter dispersae, erectae, plus minusve irregulariter curvatae, haud uncinatae, 220–340 x 8–9μ, simplices obtusae. Perithecia in centro plagularum laxe aggregata, atra globosa verrucosa 130–160μ diam. Sporae atrobrunneae, cylindraceae utrinque rotundatae, 4-septatae, leniter constrictae 34–39 x 13–16μ.

Hab. in foliis *Cissampeli convolvulaceae*, Agumbe, Mysore, 4.4.1945, *Thirumalachar 865*.

Colonies amphigenous, mostly epiphyllous, black, orbicular or irregular, often numerous and more or less confluent over the whole leaf, up to 1 mm. diam., thin. Mycelium of dark brown undulate hyphae 6–8μ thick, the cells mostly 20–35μ long, branching opposite or irregular at 45–90°, loosely reticulate. Capitate hyphopodia alternate, more or less antrorse, straight or bent, 20–30μ long; head cell ovate to clavate, entire, 13–20 x 9–13μ; stalk cell cylindric-cuneate 4–11μ long. Mucronate hyphopodia on separate hyphae, opposite or mostly alternate or unilateral, ampulliform, 14–23 x 6–8μ the neck 4μ thick. Mycelial setae thinly scattered, erect, more or less irregularly bent but not uncinate, 220–340 x 8–9μ, simple obtuse. Perithecia in a loose central group, black, globose, verrucose, 130–160μ diam. Spores dark brown, cylindric with rounded ends, 4-septate, slightly constricted, 34–39 x 13–16μ (average 36 x 14.5μ).

This species differs considerably from African collections on Menispermaceae.

12. **Meliola Dichapetali** sp. nov.

FIGURE 12

Plagulae epiphyllae orbiculares densae atrae velutinae, usque ad 3 mm. diam., crustosae. Mycelium ex hyphis subrectis atrobrunneis 6–8μ crassis (cellulis plerumque 10–20μ longis) opposite ramosis (45–90°) compositum, subsolidum. Hyphopodia capitata opposita vel alternata, plus minusve antrorsa 15–20μ longa, cellula basali cylindracea vel cuneata, saepe curvata 2–9μ longa; cellula apicali clavata vel ovata, apice late rotundata integra, recta vel curvata 10–14 x 8–12μ. Hyphopodia mucronata haud numerosa, dispersa, opposita vel alternata, conoidea vel ampullacea, plus minusve curvata 13–20 x 7–9μ, collo 3μ crasso. Setae myceliales numerosissimae, erectae atrae opacae rectae 200–280 x 9–11μ, apice 2–3-dentatae (–20μ) dentibus late divergentibus. Perithecia in centro plagulatum laxe aggregata, atra globosa, fere levia 120–175μ diam. Sporae atrobrunneae cylindraceae utrinque rotundatae, 4-septatae constrictae 39–44 x 15–17μ.

Hab. in foliis *Dichapetali gelonioidis*, Balehonnur, Mysore, *Thirumalachar 900*.

Colonies epiphyllous orbicular dense black velvety, up to 3 mm. diam., crustose. Mycelium of dark brown substraight hyphae 6–8μ thick, the cells mostly 10–20μ long, branching usually opposite at 45–90°, forming almost a solid plate. Capitate hyphopodia opposite or alternate, crowded, more or less antrorse, 15–20μ long; head cell clavate to ovate, widely rounded at the apex, entire, straight or bent, 10–14 x 8–12μ; stalk cell cylindric-cuneate, often bent, 2–9μ long. Mucronate hyphopodia not numerous, scattered, opposite or alternate, conoid to ampulliform, more or less bent, 13–20 x 7–9μ, neck 3μ thick. Mycelial setae very numerous, erect, opaque black straight 200–280 x 9–11μ, apex 2–3-dentate to 20μ, the teeth widely divergent. Perithecia in loose central group, black, globose, almost smooth, 120–175μ diam. Spores dark brown, cylindric with widely rounded ends, 4-septate, constricted, 39–44 x 15–17μ (average 42 x 16μ).

13. **Meliola Elaeagni** sp. nov.

FIGURE 13

Plagulae amphigenae atrae orbiculares 5–8 mm. diam., vel confluentes, tenues. Mycelium ex hyphis atrobrunneis sinuosis 6–7μ crassis (cellulis plerumque 20–25μ longis) opposite vel irregulariter ramosis (45–90°) laxe vel subdense reticulatis compositum. Hyphopodia capitata alternata, recta vel curvata, 12–23μ longa, cellula basali cylindracea 3–8μ longa, cellula apicali clavata, subglobosa vel leniter angulosa, recta vel subuncinata, integra, apice rotundata vel truncata 9–15 x 9–14μ. Hyphopodia mucronata pauca vel modice numerosa, dispersa, alternata vel opposita, ampullacea curvata 14–18 x 7–9μ, collo curvato angusto 2–3μ crasso. Setae myceliales dispersae paucae vel numerosae, erectae rectae atrae simplices acutae 400–600 x 8–9μ. Perithecia dispersa atra globosa subverrucosa 120–150μ diam. Sporae atrobrunneae cylindraceae utrinque rotundatae 4-septatae constrictae 34–40 x 13–17μ.

Hab. in foliis *Elaeagni latifoliae*, Balehonnur, Bangalore, Mysore, 20.8.1944, *Thirumalachar*.

Colonies amphigenous black orbicular 5–8 mm. diam. or confluent, thin. Mycelium of dark brown sinuous hyphae 6–7μ thick, the cells mostly 20–25μ long, branching opposite or irregular at 45–90°, loosely to subdensely reticulate. Capitate hyphopodia alternate, straight or bent, at various angles to the hyphae, 12–23μ long; stalk cell cylindric 3–8μ long; head cell clavate, subglobose or slightly angulose, straight or subuncinate,

entire, apex rounded to truncate 9–15 x 9–14μ. Mucronate hyphopodia few to rather numerous, scattered amongst the capitate, alternate or opposite, ampulliform bent 14–18 x 7–9μ, neck bent narrow, 2–3μ thick. Mycelial setae scattered, few to numerous, erect, straight, black, simple, acute, 400–600 x 8–9μ. Perithecia scattered, black, subglobose, slightly verrucose 120–150μ diam. Spores dark brown, cylindric with rounded ends, 4-septate, constricted 34–40 x 13–17μ (average 36.5 x 15μ).

14. **Meliola ficicola** sp. nov.

FIGURE 14

Plagulae epiphyllae (*M. ovatipoda* intermixtae) atrae, usque ad 3 mm. diam. vel confluentes, orbiculares subdensae. Mycelium ex hyphis atrobrunneis rectis 7.5–9μ crassis (cellulis plerumque 15–25μ longis) opposite ramosis (60–90°) dense reticulatis compositum. Hyphopodia capitata alternata antrorsa, plerumque recta 16–22μ longa, cellula basali cylindracea 3–6μ longa, cellula apicali cylindracea vel clavata, apice rotundata, integra 12–17 x 8–10μ. Hyphopodia mucronata in hyphis paucis dispersa, opposita vel alternata, ampullacea, plus minusve curvata, 15–22 x 7–10μ, collo 4μ crasso. Setae myceliales tenuiter dispersae etiam circum perithecia aggregatae, erectae rectae atrae opacae simplices acutae 200–240 x 7–9μ. Perithecia dispersa atra globosa verrucosa, usque ad 160μ diam., basi hyphis radiantibus circumdata. Sporae atrobrunneae cylindraceae vel subellipsoideae utrinque rotundatae, 4-septatae constrictae 37–45 x 16–18μ.

Hab. in foliis *Fici* sp., Balehonnur, Mysore, *Thirumalachar 894, p.p.*

Colonies epiphyllous, mixed with those of *M. ovatipoda*, black, up to 3 mm. diam. or confluent, smooth, orbicular. Mycelium of straight dark brown hyphae 7.5–9μ thick, the cells mostly 15–25μ long, branching usually opposite at 60–90°, closely reticulate. Capitate hyphopodia alternate, antrorse, usually straight, 16–22μ long; head cell cylindric to slightly clavate with rounded apex, 12–17 x 8–10μ; stalk cell cylindric 3–6μ long. Mucronate hyphopodia mixed with the capitate on few hyphae, usually towards the centre of the colony, opposite or alternate, ampulliform, more or less bent, 15–22 x 7–10μ, the neck 4μ thick. Mycelial setae thinly scattered and grouped around the perithecia, erect, straight simple acute black 200–240 x 7–9μ. Perithecia loosely scattered, each on a radiate subiculum, black globose verrucose, up to 160μ diam. Spores dark brown, cylindric to subellipsoid with rounded ends, 4-septate, constricted 37–45 x 16–18μ (average 41 x 17μ).

15. **Meliola Gardneriae** sp. nov.

FIGURE 15

Plagulae epiphyllae atrae orbiculares, usque ad 2 mm. diam., densae subvelutinae. Mycelium ex hyphis atrobrunneis, subrectis vel leniter undulatis 7–9μ crassis (cellulis plerumque 10–25μ longis) opposite ramosis (45–90°) dense reticulatis compositum. Hyphopodia capitata alternata, recta vel curvata, 15–28μ longa, cellula basali cylindracea 5–10μ longa, cellula apicali cylindracea, raro subangulosa vel sinuosa, apice rotundata, recta vel curvata 11–20 x 7–9μ. Hyphopodia mucronata dispersa pauca, plerumque alternata, conoidea vel ampullacea, plus minusve curvata 18–27 x 7–8μ Setae myceliales laxe dispersae, erectae subrectae simplices acutae 300–400 x 8–9μ. Perithecia laxe dispersa atra globosa verrucosa, usque ad 160μ diam. Sporae atrobrunneae cylindraceae utrinque rotundatae, 4-septatae constrictae 36–42 x 17–20μ.

Hab. in foliis *Gardneriae* sp., Balehonnur, Mysore, 29.4.1945, *Thirumalachar 869*.

Colonies epiphyllous, up to 2 mm. diam., closely scattered but not confluent, orbicular, black dense numerous subvelvety. Mycelium of substraight to slightly undulate dark brown hyphae 7–9μ thick, the cells mostly 10–25μ long, branching opposite at 45–90°, closely reticulate. Capitate hyphopodia alternate only, straight or bent, 15–28μ long; head cell cylindric with rounded apex, straight or bent, 11–20 x 7–9μ, occasionally somewhat angulose or sinuous; stalk cell cylindric 5–10μ long. Mucronate hyphopodia scattered, few, mostly alternate, conoid to ampulliform, more or less bent, 18–27 x 7–8μ. Mycelial setae thinly scattered, erect opaque black, substraight simple acute 300–400 x 8–9μ. Perithecia loosely scattered black globose verrucose, up to 160μ diam. Spores dark brown, cylindric with rounded ends, 4-septate, constricted, 36–42 x 17–20μ (average 40 x 19μ).

16. **Meliola Heyniae** sp. nov.

FIGURE 16

Plagulae epiphyllae atrae orbiculares, usque ad 3 mm. diam., tenues, in confluendo irregulares, tenuiter velutinae. Mycelium ex hyphis atrobrunneis subrectis 6–7μ crassis (cellulis plerumque 15–20μ longis) opposite ramosis (60–90°) laxe reticulatis compositum. Hyphopodia capitata alternata late antrorsa (45–60°) plerumque recta, 17–21μ longa, cellula basali cylindracea vel cuneata 4–7μ longa, cellula apicali cylindraceo-clavata, apice late rotundata 12–16 x 8–10μ. Hyphopodia mucronata dispersa, modice numerosa, opposita vel alternata, ampullacea vel conoidea, plus minusve curvata, 15–20 x 7–9μ, collo 3–4μ crasso. Setae myceliales plerumque juxta perithecia evolutae, erectae atrae opacae simplices acutae, rectae 160–300 x 7–8μ. Perithecia dispersa atra globosa verrucosa, usque ad 180μ diam., basi hyphis radiantibus circumdata. Sporae atrobrunneae ellipsoideae vel cylindraceae utrinque rotundatae, 4-septatae constrictae 35–45 x 15–19μ.

Hab. in foliis *Heyneae trijugae*, Korekote, Thirthahalli, Mysore, 4.4.1945, *Thirumalachar 874*.

Colonies epiphyllous, thin, black, orbicular or irregular and confluent, thinly velvety, up to 3 mm. diam. Mycelium of substraight dark brown hyphae 6–7μ thick, the cells 15–20μ long, branching opposite at 60–90°, loosely reticulate. Capitate hyphopodia alternate only, at 45–60°, usually straight, 17–21μ long; head cell cylindric-clavate, widely rounded at the apex, 12–16 x 8–10μ; stalk cell 4–7μ long. Mucronate hyphopodia mixed with the capitate, fairly numerous, opposite or alternate, ampulliform to conoid, more or less bent, 15–20 x 7–9μ, neck 3–4μ thick. Mycelial setae mostly grouped around the perithecia, erect, black, simple acute, 160–300 x 7–8μ. Perithecia scattered, each with a radiate mycelial subiculum around the base, black globose verrucose, up to 180μ diam. Spores dark brown, ellipsoid to cylindric with rounded ends, 4-septate constricted 35–43 x 15–19μ (average 40 x 17μ).

17. **Meliola Holarrheniae** sp. nov.

FIGURE 17

Plagulae amphigenae plerumque epiphyllae, late confluentes, tenues atrae, tenuiter velutinae. Mycelium ex hyphis atrobrunneis, subrectis vel leniter sinuosis, 5–7μ crassis (cellulis plerumque 15–25μ longis) opposite ramosis (45–90°) laxe vel subdense reticulatis compositum. Hyphopodia capitata alternata, rarissime etiam opposita, antrorsa

vel erecta, plerumque recta, 14–21μ longa, cellula basali cylindracea 3–7μ longa, cellula apicali cylindracea vel ovata, apice rotundata, integra 11–16 x 8–10μ. Hyphopodia mucronata dispersa, alternata vel opposita, ampullacea vel conoidea, plus minusve curvata 15–25 x 5–7μ, collo 3μ crasso. Setae myceliales dispersae modice numerosae, erectae rectae atrae acutae simplices 250–450 x 8–9μ. Perithecia dispersa atra globosa verrucosa 150–190μ diam. Sporae atrobrunneae cylindraceae utrinque rotundatae 4-septatae constrictae 30–38 x 12–15μ.

Hab. in foliis *Holarrheniae antidysentericae*, Balehonnur, Mysore, 18.7.1944, *Thirumalachar*.

Colonies amphigenous, mostly epiphyllous and more or less confluent over the leaf, rather thin, black, thinly velvety. Mycelium of dark brown, substraight or somewhat sinuous hyphae 5–7μ thick, the cells mostly 15–25μ long, branching opposite at 45–90°, loosely to rather closely reticulate. Capitate hyphopodia alternate, much less than 1% opposite, antrorse to erect, usually straight, 14–21μ long; stalk cell cylindric 3–7μ long; head cell cylindric to ovate with rounded apex, entire, 11–16 x 8–10μ. Mucronate hyphopodia mixed with the capitate, alternate or opposite, ampulliform to conoid, more or less bent, 15–25 x 5–7μ, neck 3μ thick. Mycelial setae scattered, fairly numerous, erect, straight simple acute black 250–450 x 8–9μ. Perithecia scattered, black, globose, verrucose 150–190μ diam. Spores dark brown, cylindric with rounded ends, 4-septate, constricted, 30–38 x 12–15μ (average 34 x 14μ).

18. **Meliola Ichnocarpi** sp. nov.

FIGURE 18

Plagulae amphigenae, plerumque epiphyllae atrae tenues, usque ad 2 mm. diam., vel inconfluendo majores. Mycelium ex hyphis atrobrunneis plus minusve undulatis 5.5–7μ crassis (cellulis plerumque 20–40μ longis) opposite ramosis (45–90°) laxe reticulatis compositum. Hyphopodia capitata alternata, plus minusve curvata, 15–30μ longa, cellula basali cylindracea, recta vel curvata, 3–12μ longa, cellula apicali subglobosa ovata vel cylindraceo-clavata, apice rotundata, integra saepe curvata 11–18 x 8–12μ. Hyphopodia mucronata pauca, opposita, alternata vel dispersa, ampullacea curvata 16–22 x 5–9μ, collo curvato 3μ crasso. Setae myceliales paucae, dispersae, erectae subrectae simplices, acutae vel subobtusae, atrae 500–1000 x 8–10μ. Perithecia dispersa atra globosa verrucosa 120–170μ diam. Sporae atrobrunneae, cylindraceae vel subellipsoideae utrinque rotundatae, 4-septatae constrictae 35–41 x 14–17μ.

Hab. in foliis *Ichnocarpi frutescentis*, Hirethola, Thirthahalli, Mysore, 3.4.1945, *Thirumalachar 856*.

Colonies amphigenous, mostly epiphyllous, black, thin, up to 2 mm. diam. or confluent and larger. Mycelium of more or less undulate dark brown hyphae 5.5–7μ thick, the cells 20–40μ long, mostly about 30μ; branching opposite at 45–90°, loosely reticulate. Capitate hyphopodia alternate, more or less bent, 15–30μ long; head cell subglobose, ovate or cylindric-clavate, apex rounded, entire, often bent, 11–18 x 8–12μ; stalk cell cylindric, straight or bent 3–12μ long. Mucronate hyphopodia few, opposite, alternate or scattered, mixed with the capitate hyphopodia, ampulliform, bent, 16–22 x 5–9μ, neck bent, 3μ thick. Mycelial setae rather few, thinly scattered, erect, more or less straight, simple, acute to subacute, black opaque 500–1000 x 8–10μ thick at the base. Perithecia thinly scattered black globose verruculose 120–170μ diam. Spores dark brown, cylin-

dric to subellipsoid with rounded ends, 4-septate constricted 35–41 x 14–17μ.

19. **Meliola Kydiae-calycinae** sp. nov.

FIGURE 19

Plagulae amphigenae plerumque epiphyllae, orbiculares usque ad 4 mm. diam., atrae densae velutinae, saepe numerosae et late confluentes. Mycelium ex hyphis atrobrunneis sinuosis 7–9μ crassis (cellulis 20–30μ longis) opposite vel irregulariter ramosis (60–90°) dense reticulatis compositum. Hyphopodia capitata alternata suberecta 15–24μ longa, recta vel curvata, cellula basali cylindracea 4–10μ longa, cellula apicali irregulariter angulosa vel sub-3-lobata, recta vel curvata, 10–15 x 12–19μ. Hyphopodia mucronata pauca, in hyphis distinctis evoluta, opposita vel alternata, ampullacea vel conoidea 16–23 x 6–8μ, collo 3–4μ crasso. Setae myceliales numerosae, dense dispersae et juxta perithecia aggregatae, erectae rectae vel irregulariter curvatae, haud hamatae, opacae simplices, acutae vel apiculato-acutae (rarissime obtusae) 220–340 x 11–14μ. Perithecia dispersa atra globosa usque ad 180μ diam., cellulis parietis late conoideis prominentibus. Sporae anguste ellipsoideae vel cylindraceae, atrobrunneae utrinque rotundatae, 4-septatae, leniter constrictae 33–39 x 10–12μ.

Hab. in foliis *Kydiae calycinae*, Agumbe, Mysore, 4.4.1945, *Thirumalachar 852*.

Colonies amphigenous, mostly epiphyllous, orbicular, up to 4 mm. diam., black, dense, velvety, often numerous and subconfluent over the whole leaf. Mycelium of crooked dark brown hyphae 7–9μ thick, the cells 20–30μ long, branching opposite or irregular at 60–90°, densely reticulate. Capitate hyphopodia alternate at wide angles, 15–24μ long, straight or bent; head cell irregularly angulose to sub-3-lobed, straight or bent, usually broader than long, 10–15 x 12–19μ; stalk cell cylindric 4–10μ long. Mucronate hyphopodia rather few, on separate hyphae, opposite or alternate, ampulliform to conoid 16–23 x 6–8μ, neck 3–4μ thick. Mycelial setae numerous, closely scattered over the mycelium and grouped around the base of the perithecia, erect, straight or irregularly bent, not hamate, opaque black to the tips, simple, rarely obtuse, usually acute to apiculate-acute, 220–340 x 11–14μ. Perithecia closely scattered over the colony, black globose verrucose, up to 180μ diam.; the surface cells broadly conoid; entirely without setae. Spores narrowly ellipsoid to cylindric with rounded ends, dark brown, 4–septate, sligthly constricted 33–39 x 10–12μ (average 35 x 11.5μ).

20. **Meliola Mangiferae** Earle in Bull. New York Bot. Gard. **3**: 307. 1905.

FIGURE 20

On *Mangifera indica*, Thirthahalli, Mysore, *Thirumalachar 877 p.p.*

Colonies amphigenous black orbicular, up to 3 mm. diam., dense and velvety. Mycelium of substraight dark brown hyphae 8–9μ thick, the cells mostly 20–25μ long, branching usually opposite at 45–60°, densely reticulate. Capitate hyphopodia alternate or very rarely opposite, usually more or less antrorse, straight or variously bent, 18–35μ long; stalk cell cylindric 5–11μ long; head cell cylindric-clavate with rounded apex, often bent, less commonly ovate to rounded-angulose or somewhat irregular, 12–24 x 10–13μ. Mucronate hyphopodia scattered, alternate or opposite, ampulliform, more or less bent, 18–25 x 7–9μ, with elongate neck 4μ thick.

Mycelial setae numerous, erect straight black, up to 600μ long by 9–11μ thick, attenuate above to the obtuse or more commonly very shortly 2–3-dentate apex. Perithecia scattered black globose verrucose up to 220μ diam. Spores dark brown, ellipsoid with rounded ends, 4-septate, constricted, 48–54 x 23–27μ.

21. **Meliola Memecyli** Sydow in Ann. Mycol. **12**: 198. 1914.

FIGURE 21

On *Memecylon Talbotianum*, Agumbe, Mysore, 5.4.1945, *Thirumalachar 870*.

Colonies amphigenous black orbicular 1–3 mm. diam., dense, velvety, numerous, closely scattered and sometimes confluent. Mycelium of dark brown substraight hyphae 8–10μ thick, the cells mostly 20–25μ long; branching opposite at 45–90°, closely reticulate. Capitate hyphopodia alternate or very rarely opposite, 16–23μ long, more or less antrorse; head cell widely cylindric-clavate with rounded apex, entire, 11–16 x 10–12μ; stalk cell cylindric 3–8μ long. Mucronate hyphopodia scattered, opposite or alternate, bent ampulliform to conoid, 17–28 x 8–10μ, the neck 3–5μ thick. Mycelial setae numerous, scattered over the mycelium and also grouped around the perithecia, erect straight or slightly bent, opaque black, simple, obtuse, up to 1600 x 9–12μ. Perithecia scattered, black globose verrucose, 140–210μ diam. Spores dark brown, cylindric with rounded ends, 4-septate, rather deeply constricted, 38–46 x 17–21μ (average 42 x 19μ).

From the above the collection on *Memecylon edulis*, Bannerguatea, Bangalore, Mysore, 24.12.1944, *Thirumalachar*, differs somewhat:

FIGURE 22

The colonies are rather larger; capitate hyphopodia up to 1% opposite, often slightly narrower; mycelial setae only up to 700μ long with apex obtuse or 2–4-dentate (–8μ); perithecia up to 220μ diam., and spores cylindric to subellipsoid, 42–51 x 18–23μ, averaging 47 x 20μ.

22. **Meliola ovatipoda** sp. nov.

FIGURE 23

Plagulae epiphyllae atrae tenues orbiculares, usque ad 3 mm. diam., vel confluentes. Mycelium ex hyphis atrobrunneis subrectis vel undulatis, 6μ crassis (cellulis 15–20μ longis) opposite ramosis (60–90°) laxe reticulatis compositum. Hyphopodia capitata alternata, antrorsa, plerumque recta 18–29μ longa, cellula basali cylindracea 4–15μ longa, cellula apicali ovata integra 10–16 x 9–12μ. Hyphopodia mucronata in hyphis distinctis evoluta, opposita vel alternata, ampullacea, plus minusve curvata 15–22 x 6–8μ, collo 3μ crasso. Setae myceliales praecipue juxta perithecia evolutae, erectae atrae opacae, subrectae vel irregulariter curvatae, haud hamatae, simplices acutae, usque ad 200 x 8–9μ. Perithecia laxe dispersa, atra globosa verrucosa, usque ad 160μ diam., basi hyphis radiantibus circumdata. Sporae atrobrunneae cylindraceae utrinque rotundatae 4-septatae constrictae 29–37 x 13–16μ.

Hab. in foliis *Fici* sp., Balehonnur, Mysore, *Thirumalachar 894 p.p.*

Colonies epiphyllous, (mixed with *M. ficicola* and distinguished from this by the thinner colonies with rather more flexuous mycelium, narrower hyphae with different hyphopodia) thin, black orbicular smooth, up to 3

mm. diam. or confluent. Mycelium of substraight to slightly wavy dark brown hyphae 6μ thick, the cells 15–20μ long, branching opposite at 60–90°, loosely reticulate. Capitate hyphopodia alternate, more or less antrorse, usually straight, 17–29μ long; head cell ovate entire, 10–16 x 9–12μ; stalk cell cylindric 4–15μ long. Mucronate hyphopodia on separate hyphae, opposite or alternate, ampulliform, more or less bent, 15–22 x 6–8μ, the neck 3μ thick. Mycelial setae usually only around the perithecia, few, erect black substraight or irregularly bent but not uncinate or hamate, simple acute, up to 200 x 8–9μ. Perithecia loosely scattered, each on a radiate subiculum of hyphopodiate hyphae, black, globose, verrucose, up to 160μ diam. Spores dark brown, cylindric with rounded ends, 4-septate, constricted 29–37 x 13–16μ (average 32 x 14μ).

23. **Meliola tabernaemontanicola** sp. nov.

FIGURE 24

Plagulae epiphyllae, raro etiam hypophyllae, atrae, tenues vel subdensae, orbiculares, usque ad 4 mm. diam., velutinae, saepe numerosae confluentesque. Mycelium ex hyphis atrobrunneis, subrectis vel leniter undulatis 6–7μ crassis (cellulis plerumque 20–25μ longis) opposite ramosis (45–90°) laxe vel subdense reticulatis compositum. Hyphopodia capitata alternata, rarissime opposita, plus minusve antrorsa, plerumque recta, 15–24μ longa, cellula basali cylindracea 3–9μ longa, cellula apicali ovata vel cylindracea, apice rotundata integra 12–17 x 8–10μ. Hyphopodia mucronata dispersa, opposita vel alternata, curvata ampullacea 13–19 x 6–8μ, collo 3μ crasso. Setae myceliales numerosae dispersae et juxta perithecia aggregatae, erectae, rectae vel curvulae, simplices acutae atrae 200–450 x 7–9μ. Perithecia dispersa atra globosa verrucosa, usque ad 170μ diam. Sporae atrobrunneae, cylindraceae utrinque rotundatae, 4–septatae constrictae 30–36 x 13–15μ.

Hab. in foliis *Tabernaemontanae* sp., Balehonnur, Mysore, 28.8.1944, *Thirumalachar 860*.

Colonies epiphyllous, rarely also hypophyllous, black, thin to subdense, orbicular, up to 4 mm. diam., or numerous and confluent, velvety. Mycelium of substraight to slightly undulate dark brown hyphae 6–7μ thick, the cells mostly 20–25μ long, branching opposite at 45–90°, loosely to subdensely reticulate. Capitate hyphopodia alternate, very rarely opposite, more or less antrorse, usually almost straight, 15–24μ long; head cell ovate to cylindric with rounded apex, entire, 12–17 x 8–10μ; stalk cell cylindric 3–9μ long. Mucronate hyphopodia scattered, opposite or alternate, bent ampulliform 13–19 x 6–8μ, the neck 3μ thick. Mycelial setae numerous, scattered and also grouped around the perithecia, erect straight or slightly bent, simple, acute black 200–450 x 7–9μ. Perithecia scattered black globose verrucose, up to 170μ diam. Spores dark brown, cylindric with rounded ends, 4-septate constricted 30–36 x 13–15μ (average 34 x 14μ).

24. **Meliola Tecleae** Hansf. var. **Toddaliae-asiaticae** Hansf. in Proc. Linn. Soc. London, Session 153, p. 11. 1941.

FIGURE 25

On *Toddalia asiatica* var. *floribunda*, Balehonnur, Mysore, 29.4.1945, *Thirumalachar 875*.

Colonies epiphyllous orbicular scattered, up to 3 mm. diam., black dense velvety. Mycelium of straight dark brown hyphae 8–9μ thick. the cells

15–30μ long, branching opposite at 60–90°, closely reticulate. Capitate hyphopodia alternate, very rarely opposite, more or less widely antrorse, usually straight, 19–24μ long; head cell cylindric to clavate with rounded apex, entire, 13–18 x 9–12μ. Mucronate hyphopodia mixed with the capitate, opposite or alternate conoid to ampulliform, 15–22 x 7–10μ, the neck more or less bent, 4–5μ thick. Mycelial setae numerous scattered erect black opaque simple acute rigid, 300–500 x 10–12 μ. Perithecia closely scattered, black globose verrucose 140–190μ diam. Spores dark brown, cylindric to ellipsoid with rounded ends, constricted 4-septate 40–47 x 17–20μ (average 45 x 18.5μ).

25. **Meliola toddaliicola** Hansf. var. **indica** var. nov.

FIGURE 26

Plagulae paucae, dispersae atrae densae orbiculares, usque ad 3 mm. diam., epiphyllae. Mycelium ex hyphis atrobrunneis subrectis 6–7μ crassis (cellulis plerumque 13–20μ longis) opposite ramosis (saepe 90°) dense reticulatis compositum. Hyphopodia capitata opposita vel usque ad 30% alternata, late antrorsa, 13–20μ longa, cellula basali cylindracea 2–5μ longa, cellula apicali late ovata, integra 10–15 x 8–10μ. Hyphopodia mucronata dispersa, opposita vel alternata, ampullacea, curvata 12–20 x 7–9μ, collo 3–4μ crasso. Setae myceliales praecipue juxta perithecia evolutae, erectae atrae rectae opacae simplices acutae 200–280 x 7–9μ. Perithecia dispersa atra globosa verrucosa 120–150μ diam. Sporae atrobrunneae cylindraceae utrinque rotundatae, 4-septatae leniter constrictae 39–44 x 15–17μ.

Hab. in foliis *Toddaliae asiaticae* var. *floribundae*, Balehonnur, Mysore, 29.4.1945, *Thirumalachar 875 p.p.*

Colonies few, scattered black dense up to 3 mm. diam., orbicular, epiphyllous. Mycelium of substraight dark brown hyphae 6–7μ thick, the cells 15–20μ long, branching opposite subrectangular, closely reticulate. Capitate hyphopodia opposite or up to 30% alternate, widely antrorse, 13–20μ long; head cell wide ovate entire 10–15 x 8–10μ; stalk cell cylindric 2–5μ long. Mucronate hyphopodia scattered, opposite or alternate, ampulliform, bent, 12–20 x 7–9μ, neck 3–4μ thick. Mycelial setae mostly grouped around the perithecia, erect straight black opaque simple acute 200–280 x 7–9μ. Perithecia scattered black globose verrucose, 120–150μ diam. Spores dark brown cylindric with rounded ends, 4-septate constricted 39–44 x 15–17μ (41 x 16μ).

26. **Meliola Zizyphi** sp. nov.

FIGURE 27

Plagulae epiphyllae tenues atrae orbiculares, tenuiter velutinae, usque ad 3 mm. diam., vel numerosae confluentesque. Mycelium ex hyphis atrobrunneis subrectis vel undulatis 5–6μ crassis (cellulis 20–30μ longis) opposite ramosis, subrectangulariter laxeque reticulatis compositum. Hyphopodia capitata alternata vel usque ad 5% opposita late antrorsa vel reflexo-curvata 10–17μ longa, cellula basali cylindracea 2–6μ longa, cellula apicali cylindraceo-clavata, saepe curvata, integra 8–12 x 7–9μ. Hyphopodia mucronata dispersa, haud numerosa, opposita vel alternata, ampullacea, plus minusve curvata, 13–19 x 5–7μ, collo elongato 3μ crasso. Setae myceliales laxe dispersae, erectae atrae simplices acutae, rectae vel leniter curvatae (haud uncinatae) 250–400 x 6–7μ. Perithecia dispersa atra globosa verrucosa 120–140μ diam. Sporae at-

robrunneae cylindraceae utrinque rotundatae, 4-septatae leniter constrictae 30–36 x 11–14μ.

Hab. in foliis *Zizyphi rugosae*, Balehonnur, Mysore, 28.4.1945, *Thirumalachar 850*.

Colonies epiphyllous, thin black orbicular, thinly velvety, up to 3 mm. diam., or numerous and confluent over the leaf. Mycelium of substraight to undulate or slightly crooked hyphae, dark brown, 5–6μ thick, the cells 20–30μ long, branching opposite and subrectangular, loosely reticulate. Capitate hyphopodia alternate or up to 5% opposite, at wide angles and often reflexed-bent, 10–17μ long; head cell cylindric-clavate, often bent, entire, 8–12 x 7–9μ; stalk cell cylindric 2–6μ long. Mucronate hyphopodia scattered, not numerous, opposite, alternate or solitary, ampulliform, more or less bent, 13–19 x 5–7μ, neck elongate 3μ thick. Mycelial setae thinly scattered erect black simple acute, straight or somewhat bent, not uncinate, 250–400 x 6–7μ. Perithecia scattered loosely, black globose verrucose, 120–140μ diam. Spores dark brown, cylindric with rounded ends, 4-septate constricted 30–36 x 11–14μ (average 34 x 12.5μ).

27. **Dimeriella Salaciae** sp. nov.

FIGURE 28

Plagulae hypophyllae, haud perspicues; mycelium ex hyphis superficialibus hyalinis exhyphopodiatis 2–3.5μ crassis, indistincte septatis, irregulariter denseque ramosis, laxe reticulatis compositum. Setae myceliales laxe dispersae, ex nodo mycelii ortae, erectae simplices obtusae septatae atrobrunneae subrectae 300–450μ alt., 4–5μ cr., apice 3μ crassae. Perithecia laxe dispersa superficialia globosa 60–100μ diam. atra, basi hyphis mycelii circumdata; paries unistratosus ex cellulis angulosis brunneis 10μ diam. et 5μ cr. compositus, sursum cellulis in circulos circum poro apicalum dispositis; porus circa 15μ diam. Setae peritheciales erecto-patentes, ex parte superiore perithecii ortae, 15–23, atrobrunneae, rectae septatae simplices obtusae 50–110 x 4–5μ. Asci numerosi aparaphysati erecti, late ellipsoidei vel saccati, apice rotundati incrassati (–14μ) sessiles, 8-spori, 50 x 20μ. Sporae multiseriatae vel sub-parallelae, cylindraceae vel leniter clavulatae, utrinque rotundatae, hyalinae, 1-septatae haud constrictae, leves 18–22 x 3.5–4μ.

Hab. in foliis *Salaciae* sp., Balehonnur, Mysore, *Thirumalachar*.

Hypophyllous, not forming visible colonies; mycelium of superficial hyaline exhyphopodiate hyphae 2–3.5μ thick, indistinctly septate, irregularly and closely branched, forming a loose reticulum. Mycelial setae thinly scattered, each arising from a small knot of pale brown mycelial hyphae, erect, simple obtuse septate, dark brown, more or less straight, 300–450 x 4–5μ, gradually attenuate to 3μ at the apex. Perithecia loosely scattered, completely superficial, globose 60–100μ diam., black; wall of a single layer of angular parenchyma, brown, about 10μ diam. and 5μ thick; towards the apex the cells somewhat smaller and arranged in irregular rings about the slightly papillate terminal round pore, which is about 15μ diam. Perithecial setae erect-spreading, arising from the upper half of the perithecial wall, 15–23, dark brown, straight, septate, simple, obtuse, 50–110 x 4–5μ. Asci numerous, aparaphysate, erect, broadly ellipsoid to saccate, rounded and when young thickened at the apex to 14μ, sessile, 8-spored, 50 x 20μ. Spores multiseriate or subparallel, cylindric to slightly clavulate

with rounded ends, hyaline, 1-septate, not constricted, smooth, 18–22 x 3.5–4 μ.

The mycelium with its setae are closely akin to those of the family Chaetothyriaceae, but the globose perithecium with its parenchymatous wall and round apical pore separate the fungus from that family, and there is no trace of an outer mycelial covering on the perithecium.

28. **Chaetothyrium mysorensis** sp. nov.

FIGURE 29

Mycelium epiphyllum, late effusum, ex hyphis hyalinis 2–3μ crassis, indistincte septatis, laxe reticulatis compositum, juxta perithecia dense reticulatum pelliculosum. Setae myceliales juxta perithecia aggregatae, interdum etiam laxe dispersae, erectae, opace atrae, rectae simplices acutae, usque ad 200 x 8–10μ. Perithecia laxe dispersa, superficialia glabra atra nitentia depresso-globosa, 150–210μ diam. et circa 70μ alt., in sicco cupulato-collapsa. Paries exterior ex hyphis sinuosis 2–4μ crassis compositus, plectenchymaticus, atrobrunneus; paries interior ex cellulis angulosis hyalinis 3–5μ diam. compositus, totus circa 5μ crassus. Asci numerosi basales erecti aparaphysati, late clavati, superne late rotundati, haud incrassati, subsessiles, tenuiter tunicati, in maturitate 55–60 x 20–25μ, 8-spori. Sporae parallelae cylindraceo-clavulatae, rectae vel leniter curvatae, utrinque rotundatae, hyalinae, leves, transverse 7–9-septatae, haud constrictae, 45–50 x 5μ.

Hab. in foliis *Salaciae* sp., Balehonnur, Mysore, 28.3.1945, *Thirumalachar*.

Mycelium epiphyllous, not forming visible colonies, widely spreading, hyaline, thin, loosely reticulate, of indistinctly septate thin-walled hyphae 2–3μ thick, becoming closely reticulate and thinly pelliculose around the setae and perithecia. Setae usually grouped around each perithecium, sometimes also scattered irregularly and thinly over the mycelium, erect, black, straight, simple acute, up to 200 x 8–10μ, quite opaque from base to tip. Perithecia loosely scattered, each surrounded by a ring of 6–10 mycelial setae, otherwise quite glabrous and smooth, black, shining, flattened globose, when dry cupulate-collapsed, 150–210μ diam., about 70μ high, completely superficial. Upper and outer wall of dark brown wavy plectenchyma continuous with the mycelial pellicle around the base and fused above with the inner true wall of delicate angular parenchyma 3–5μ diam.; whole wall about 5μ thick. Asci numerous, basal erect aparaphysate, broadly clavate, widely rounded above, not thickened at the apex, attenuate downwards to the subsessile base, thin-walled, when mature 55–60 x 20–25μ. Spores 8, parallel, cylindric-clavulate straight or slightly bent, the ends rounded, hyaline smooth, transversely 7–9-septate, not constricted, 45–50 x 5μ.

29. **Hariotula Capparidis** sp. nov.

Maculae epiphyllae rotundatae indistincte marginatae, elevatae, subinde inferne invaginatae, circa 5 mm. diam., ochraceae, haud secedentes, ab hypophyllo haud perspicues. Mycelium externum nullum; internum ex plagulis rotundatis hyalinis in cellulis epidermidis folii compositum. Thyriothecia superficialia atra rotundata discreta laxe dispersa, epiphylla, 120–160μ diam., convexa levia, margine haud fimbriata; paries inferior ex hyphis hyalinis angustis radiantibus indistinctis compositum; paries superior ex hyphis radiantibus atrobrunneis 4–6μ crassis (cellulis 6-10μ longis) compositus, in maturitate irregulariter dehiscens et cellulis centralibus secedentibus. Asci

3–6, globosi sessiles, tenuiter tunicati, 8-spori 35–40μ diam., aparaphysati. Sporae conglobatae, atrobrunneae, oblongae utrinque rotundatae, 1-septatae constrictae leves 22–26 x 12–13μ, cellula superiore leniter crassiore.

Hab. in foliis *Capparidis sepiariae*, Nandi, Mysore, 16.11.1944, *Thirumalachar*.

Leafspots epiphyllous, circular, rather indefinite, raised and sometimes invaginated below, about 5 mm. diam., yellowish brown, not drying out, not visible from the lower surface of the leaf. Upper epidermis filled with orange to yellow oil drops, often simulating a septate mycelium. Internal mycelium in the upper part of the epidermal cells, consisting of hyaline plates of flattened cells about 6–9μ diam., forming thin plates closely adherent to the upper wall of the host cell, passing directly from one cell to the next. Thyriothecia superficial, black, circular, discrete, loosely scattered, epiphyllous only, 120–160μ diam., convex, smooth, not fimbriate at the edge; lower wall of hyaline delicate hyphae radiating from the central point of attachment through the cuticle to the internal mycelium, very difficult to see; upper wall of dark brown radiating hyphae 4–6μ thick, the cells 6–10 μ long, at maturity irregularly dehiscent in the centre, and then the central cells falling away. Asci 3–6, globose, sessile, thin-walled, 8-spored, about 35–40μ diam. Spores conglobate, dark brown, oblong with rounded ends, 1-septate, constricted, smooth, 22–26 x 12–13μ, the upper cell slightly larger than the lower.

30. **Hariotula Convolvuli** sp. nov.

Thyriothecia epiphylla, dense aggregata, atra rotundata convexa; plerumque discreta 80–120μ diam., sine mycelium externum; paries inferior hyalinus indistinctus; paries superior ex hyphis radiantibus atrobrunneis 4–5μ crassis (cellulis 5–8μ longis) compositus, margine haud fimbriatus, irregulariter stellatim dehiscens usque ad marginem. Thyriothecia centraliter ad mycelium hyalinum subcuticulare ex hyphis septatis 3–4μ crassis compositum conjuncta, haustoriis nullis. Asci 6–10, in ordine maturescentes, globosi sessiles 8-spori, circa 20μ diam., aparaphysati. Sporae conglobatae brunneae oblongae utrinque rotundatae, 1-septatae, leniter constrictae, leves 12–15 x 6–7.5μ cellula superiore saepe leniter crassiore.

Hab. in foliis *Convolvuli* sp., Bangalore, Mysore, 11.11.1944, *Thirumalachar*.

Thyriothecia epiphyllous, closely scattered and covering an irregular area of the leaf, without superficial mycelium, black, circular convex, usually discrete, 80–120μ diam.; upper wall at first of somewhat radiating dark brown hyphae 4–5μ thick, the cells 5–8μ long, not fimbriate at the margin, dehiscent by irregularly stellate fissures to the margin and the segments becoming erect and more or less surrounding the exposed ascus layer, which is embedded in pale brownish mucus; lower thyriothecial wall hyaline, very indistinct. Asci 6–10, ripening in succession, sessile, globose, thin-walled, 8-spored, about 20μ diam., aparaphysate. Spores conglobate, brown, oblong with rounded ends, 1-septate, slightly constricted, smooth, 12–15 x 6–7.5μ, the upper cell often slightly larger than the lower. The thyriothecia are centrally attached to a subcuticular hyaline mycelium of septate hyphae 3–4μ thick, spreading over the epidermal cells without formation of haustoria.

The fungus is somewhat closely allied to *Ferrarisia Ipomoeae*, but differs in its internal mycelium.

31. **Stephanotheca Oleae** sp. nov.

FIGURE 30

Thyriothecia hypophylla rotundata discoidea atra levia, usque ad 240μ diam., plerumque discreta, dense dispersa, omnino superficialia sine mycelium perspicuum. Paries superior ex hyphis atrobrunneis radiantibus 4–5μ crassis (cellulis 5–8μ longis) compositus, margine crenatus, haud fimbriatus, irregulariter dehiscens. Paries thyrothecii inferior ex hyphis dilute brunneis vel subhyalinis indistincte radiantibus compositus. Asci in hymenio annulato dispositi, numerosi aparaphysati subglobosi vel ovati, nodoso-stipitati 25–35 x 20–25μ, 8-spori, apice incrassati –2μ. Sporae conglobatae hyalinae ovato-ellipsoideae utrinque rotundatae, transverse 3-septatae, haud vel leniter constrictae, leves 13–15 x 5–6μ, cellulis centralibus longitudinaliter 1-septatis.

Hab. in foliis *Oleae dioicae*, Balehonnur, Mysore, *Thirumalachar 887*.

Thyriothecia hypophyllous, circular, discoid, flat, black, smooth, up to 240μ diam., closely scattered but usually discrete, apparently completely superficial and with no evident free mycelium. Upper wall of dark brown radiate hyphae 4–5μ thick, the cells 5–8μ long, the marginal cells up to 10μ long, crenate at the margin but not fimbriate, the terminal cells of the hyphae somewhat loose. Lower wall of indistinctly radiating pale brown to subhyaline hyphae. Dehiscence is by irregular fracture of the upper wall. The asci are arranged in a close hymenium extending all round the sterile centre, separated by the loose remains of the stroma tissue of globose subhyaline cells 3–5μ diam. Asci subglobose to ovate, contracted below into a short nodose stipe, 25–35 x 20–25μ, aparaphysate 8-spored, with wall thickened up to 2μ around the apex. Spores more or less conglobate, hyaline, ovate-ellipsoid with rounded ends, transversely 3-septate, not or slightly constricted, smooth, the middle cells with one longitudinal septum, 13–15 x 5–6μ.

32. **Asterolibertia Mangiferae** sp. nov.

FIGURE 31

Plagulae epiphyllae atrae orbiculares, usque ad 7 mm. diam., dispersae tenues leves. Mycelium ex hyphis atrobrunneis subrectis 7μ crassis (cellulis plerumque 20–30μ longis) opposite vel irregulariter ramosis (45–90°) laxe reticulatis compositum. Hyphopodia intercalaria dispersa solitaria, in hyphis primariis efformata, doliformia 12–15 x 10–11μ, continua, inferne poro conspicuo perforata. Ascomata dispersa, plerumque discreta, atra rotundata convexa levia, 250–300μ diam., paries inferior indistinctus; paries superior ex hyphis radiantibus opace atrobrunneis 5μ crassis (cellulis 5–12μ longis) compositus, margine fimbriatus, hyphis fimbriarum subtiliter undulatis, radiantibus, usque ad 160μ longis, exhyphopodiatis; thyriothecium irregulariter dehiscens et cellulis centralibus secendentibus. Asci usque ad 15, in ordine maturescentes, aparaphysati globosi sessiles, usque ad 70μ diam., 4–8-spori. Sporae conglobatae atrobrunneae oblongae utrinque rotundatae, rectae vel leniter curvatae, 1-septatae constrictae leves 35–42 x 16–19μ, cellulis subaequalibus vel superiore leniter crassiore. Pycnidia et conidia nulla.

Hab. in foliis *Mangiferae indicae*, Thirthahalli, Mysore, 4.4.1945, *Thirumalachar 877*.

Colonies epiphyllous, black orbicular, up to 7 mm. diam., discrete, scattered, thin, smooth. Mycelium of straight dark brown hyphae 7μ thick, the cells mostly 20–30μ long, branching opposite or irregular at 45–90°, loosely reticulate. Hyphopodia intercalary, scattered singly on the main hyphae only, not regularly distributed, barrel-shaped 12–15 x 10–11μ, with a conspicuous pore on the lower surface. Ascomata scattered, usually

discrete, black rounded, flattened conic, smooth, 250–300 μ diam.; lower wall indistinct; upper wall of opaque black-brown radiating hyphae 5μ thick, the cells cubical in the centre, up to 12μ long towards the margin; margin fimbriate, the fringing hyphae finely undulate, radiating, up to 160μ long, exhyphopodiate; dehiscence irregularly stellate, the centre breaking up and falling away. Asci up to 15, ripening in succession, aparaphysate, globose sessile, up to 70μ diam. when fully mature, 4–8-spored. Spores conglobate, dark brown, oblong with rounded ends, straight or slightly bent, 1-septate, constricted, smooth, 35–42 x 16–19μ, the cells subequal or the upper slightly larger. Pycnidia and conidia none.

33. **Asterina cansjericola** sp. nov.

FIGURE 32

Plagulae amphigenae atrae numerosae subdensae orbiculares, plerumque discretae 3–4 mm. diam., leves. Mycelium ex hyphis atrobrunneis, subrectis vel leniter sinuosis 5–7μ crassis (cellulis plerumque 25–40μ longis) opposite vel irregulariter ramosis (45–60°) laxe reticulatis compositum. Hyphopodia alternata vel unilateralia, interdum (–5%) opposita, conoidea, plerumque leniter curvata, atrobrunnea 12–16 x 6–8μ, sursum leniter attenuata, apice rotundata 4–5μ crassa. Thyriothecia dense dispersa, numerosa rotundata convexa atra, usque ad 160μ diam. vel 2–3-connata; paries inferior hyalinus subradiatus indistinctus; paries superior subopace atrobrunneus ex hyphis radiantibus 4–5μ crassis (cellulis 5–10μ longis) compositus, stellatim dehiscens et cellulis centralibus secedentibus, margine subfimbriatus, hyphis fimbriarum dilute brunneis, tortuoso-radiantibus exhyphopodiatis, usque ad 40μ longis. Asci 4–6, in ordine maturescentes aparaphysati globosi vel ellipsoidei, 8-spori, usque ad 50 x 40–45μ. Sporae conglobatae atrobrunneae, oblongae utrinque rotundatae, 1-septatae, fortiter constrictae 28–34 x 14–17μ, exosporio tenuiter denseque echinulato. Pycnidia thyrotheciis consimilia; pycnosporae piriformes atrobrunneae leves continuae, circa 27 x 18μ.

Hab. in foliis *Cansjerae Rheedii*, Nandi Hills, Mysore, 18.11.1944, *Thirumalachar*.

Colonies amphigenous, black, numerous, rather dense, rounded, usually discrete, 3–4 mm. diam., smooth. Mycelium of substraight or slightly sinuous dark brown hyphae 5–7μ thick, the cells mostly 25–40μ long, branching opposite or irregular at 45–60° loosely reticulate. Hyphopodia alternate or unilateral, in some colonies up to 5% opposite, conoid, usually slightly bent, dark brown, 12–16 x 6–8μ thick at the base, slightly attenuate to the rounded apex 4–5μ thick. Thyriothecia densely scattered, numerous, circular convex black, up to 160μ diam., or 2–3-connate into irregular compound ascomata; lower wall indistinct, hyaline, subradiate; upper wall subopaque dark brown, radiate, the hyphae 4–5μ thick with cells 5–10μ long; dehiscence by stellate fissures and the central parts falling away; margin usually slightly fimbriate, the fringing hyphae paler than the mycelium, tortuous-radiating, exhyphopodiate, up to 40μ long. Asci few, 4–6, ripening in succession, globose to ellipsoid, 8-spored, aparaphysate, up to 50μ high by 40–45μ diam. Spores conglobate, dark brown, oblong with rounded ends, 1-septate, deeply constricted 28–34 x 14–17μ, exospore finely and closely echinulate. Pycnidia similar to the thyriothecia; pycnospores piriform, dark brown, smooth, about 27 x 18μ, without a hyaline band or prominent germ pores.

34. **Asterina congesta** Cooke in Grevillea **8**: p. 95. 1879.

FIGURE 33

On *Santalum album*, Nandi Hills, Mysore, 14.10.1944, *Thirumalachar*.

Colonies amphigenous, mostly epiphyllous, black, circular, rather dense, smooth, up to 2 mm. diam., or numerous and confluent, especially on the lower surface. Mycelium of crooked dark brown hyphae 4–5μ thick, the cells mostly 10–15μ long, branching opposite or irregular, closely reticulate. Hyphopodia alternate or unilateral, continuous, dark brown, irregularly conoid or digitate, sometimes somewhat sinuous-lobate, apex obtuse, straight or bent, 5–10 x 4–8μ. Thyriothecia numerous, closely scattered and in the centre of the colony almost a solid plate; circular and discrete, up to 130μ diam., or more often confluent into large, very irregular X- or Y-shaped compound ascomata up to 280μ long. Lower wall indistinct. Upper wall of radiating dark brown hyphae 4–5μ thick, the cells 4–8μ long not or only slightly fimbriate at the margin; dehiscence by stellate fissures extending to the margin, into broadly triangular segments, partly exposing the asci. Asci 4–10, aparaphysate, globose, sessile 8-spored, 35–40 x 28–35μ, ripening in succession. Spores conglobate dark brown, oblong with rounded ends, 1-septate, constricted, smooth, 18–23 x 10–11μ, the upper cell slightly larger than the lower.

35. **Asterina Dichapetali** sp. nov.

FIGURE 34

Plagulae epiphyllae tenues atrae leves orbiculares, usque ad 3 mm. diam., saepe confluentes. Mycelium ex hyphis sinuosis atrobrunneis 4–5μ crassis (cellulis plerumque 15–20μ longis) opposite vel irregulariter ramosis, dense reticulatis compositum. Hyphopodia continua, alternata vel unilateralia, suberecta, subrecta, cylindracea apice rotundata, 5–10 x 4–5μ. Thyriothecia dense dispersa, discreta vel saepe 2–3-connata, rotundata 120–130μ diam., atra convexa; paries inferior ex hyphis dilute olivaceis vel griseis membranceis radiantibus compositus; paries superior opace atrobrunneus ex hyphis radiantibus 4–5μ crassis (cellulis 3–8μ longis) compositus, 3–5-stellatim dehiscens usque ad marginem, segmentibus late triangulatis suberectis; margine fimbriatus, hyphis fimbriarium tortuoso-radiantibus usque al 30μ longis exhyphopodiatis. Asci 4–8, globosi sessiles 25–30μ diam., 4–8-spori, aparaphysati. Sporae conglobatae, opace atrobrunneae, oblongae utrinque rotundatae, 1-septatae, constrictae, 20–24 x 10–11μ, cellula superiore leniter crassiore, episporio dense echinulato. Pycnidia thyriotheciis consimilia; pycnosporae ovatae vel piriformes, castaneae leves 17–23 x 12–15μ, poris germinationis 2–3 aequatorialibus.

Hab. in foliis *Dichapetali gelonioidis*, Balehonnur, Mysore, 29.4.1945, *Thirumalachar 900*.

Colonies epiphyllous, thin black smooth rounded, up to 5 mm. diam., or often confluent over the leaf. Mycelium closely reticulate, of dark brown crooked hyphae 4–5μ thick, the cells mostly 15–20μ long, branching opposite or irregular. Hyphopodia continuous, alternate or unilateral, at wide angles, usually straight cylindric with rounded apex, 5–10 x 4–5μ. Thyriothecia closely scattered or often 2–3-connate; when single rounded 120–130μ diam., black; basal wall of radiating pale grey or pale olivaceous hyphae forming a membrane; upper wall opaque black brown, of closely compacted dark brown hyphae 4–5μ thick, the cells 3–8μ long, the margin

more or less fimbriate and the fringing hyphae tortuous-radiating, exhyphopodiate up to 30μ long, loose. Dehiscence by 3–5 stellate fractures extending to the margin, forming broadly triangular segments becoming more or less erect around the exposed layer of asci. Asci 6–8, globose, sessile, thin-walled, 25–30μ diam., 4–8-spored, aparaphysate. Spores opaque dark brown, oblong with broadly rounded ends, 1-septate constricted, 20–24 x 10–12μ, the upper cell slightly larger than the lower; epispore closely echinulate. Pycnidia similar to the thyriothecia; pycnospores ovate to piriform, chestnut-brown, smooth, 17–23 x 12–15 μ, with 2–3 equatorial germ pores, but no hyaline band.

36. **Asterina Elaeagni** (Sydow) Sydow & Petrak in Ann. Mycol. **29:** 225. 1931.

FIGURE 35

On *Elaeagnus latifolia*, Balehonnur, Mysore, 20.8.1944, *Thirumalachar*.

Colonies epiphyllous, black, 0.5–1.0 mm. diam., with a close central group of thyriothecia. Mycelium of brown sinuous or crooked hyphae 3–4μ thick, the cells mostly 30–50μ long, branching irregular and forming a loose network. Hyphopodia scattered loosely, alternate or unilateral, brown, continuous, irregularly hemispheric to subglobose, entire, 6–8μ diam. Thyriothecia densely grouped in centre of each colony, rounded, 120–160μ diam., or confluent at the edges into irregular compound ascomata; lower wall indistinct; upper wall opaque brown, of radiating hyphae 3–4μ thick, the cells 4–8μ long, not fimbriate at the margin; dehiscense by stellate fissures with the central part falling away. Asci aparaphysate, subglobose 8-spored, sessile, about 30μ diam., 8-spored. Spores dark brown oblong, with rounded ends, smooth, 1-septate, constricted, 17–20 x 8-9μ, the upper cell slightly larger than the lower; germinating by a hyphopodium formed at the septum.

37. **Asterina erysiphoides** Kalchbr. & Cooke in Grevillea **9:** 32. 1880.

FIGURE 36

On *Jasminum rigidum*, Nandi Hills, Mysore, 16.11.1944, *Thirumalachar*.

Colonies epiphyllous, rarely hypophyllous, black, thin, smooth, round, up to 3 mm. diam. Mycelium of dark brown substraight to slightly sinuous hyphae 5μ thick, the cells mostly 20–25μ long, branching alternate or unilateral at 45–60°, loosely reticulate. Hyphopodia alternate or unilateral, concolorous, 1–(2)-septate, straight or irregularly bent, 13–22μ long, 6–12μ thick, both cells rather deeply sinuous-lobate, very irregular in shape and size. Thyriothecia scattered black convex, usually discrete and rounded, 90–130μ diam., sometimes 2–3-connate into irregular compound ascomata, lower wall of grey-olive radiating hyphae 3–3.5μ thick; upper wall of opaque dark brown radiating hyphae 4.5–5.5μ thick, the cells 5–10μ long, margin more or less fimbriate, the fringing hyphae often numerous, tortuous-radiating, paler than the mycelium, exhyphopodiate, up to 120μ long. Dehiscence by stellate fractures extending to the margin, the wall splitting into numerous narrowly triangular segments. Asci few, about 10,

aparaphysate, embedded in yellowish mucus, subglobose sessile 8-spored, about 35μ diam. Spores conglobate, dark brown, oblong with rounded ends, 1-septate, constricted, 20–27 x 11–14μ, the surface nearly smooth, the upper cell somewhat larger than the lower and subglobose.

38. **Asterina mysorensis** sp. nov.

FIGURE 37

Plagulae amphigenae atrae orbiculares leves, 2–3 mm. diam., subdensae, saepe confluentes. Mycelium ex hyphis atrobrunneis flexuosis 6–8μ crassis (cellulis plerumque 20–30μ longis) opposite vel irregulariter ramosis (45–90°) dense reticulatis compositum. Hyphopodia opposita vel alternata, continua, obtuse conoidea vel cylindracea, recta vel curvata, 10–15 x 5–8μ. Thyriothecia dense dispersa, plerumque discreta, atra rotundata convexa, usque ad 130μ diam., paries inferior indistinctus; paries superior subopace atrobrunneus, ex hyphis radiantibus 6–7μ crassis (cellulis 6–10μ longis) compositus, margine haud vel leniter fimbriatus, irregulariter stellatim dehiscens. Asci 2–4, in ordine maturescentes, globosi sessiles, aparaphysati, 8-spori, 45-50μ diam. Sporae conglobatae oblongae utrinque rotundatae, subopace atrobrunneae, 1-septatae constrictae 26–32 x 14–17μ, episporio subtiliter denseque verruculoso.

Hab. in foliis *Fici* sp., Nandi Hills, Mysore, 18.10.1944, *Thirumalachar*.

Colonies amphigenous black orbicular smooth, 2–3 mm. diam., or confluent, dense in the centre. Mycelium of crooked dark brown hyphae 6–8μ thick, the cells mostly 20–30μ long, branching opposite or irregular at 45–90°, closely reticulate. Hyphopodia opposite or alternate, continuous, bluntly conoid to cylindric with obtuse rounded apex, straight or variously bent, 10–15 x 5–8μ. Thyriothecia densely scattered, but usually discrete, black, circular, convex, up to 130μ diam.; lower wall indistinct; upper wall of subopaque dark brown radiating hyphae 6–7μ thick, the cells 6–10μ long; margin not or only slightly fimbriate; the centre dehiscent by irregularly stellate fissures and soon falling away to expose the asci. Asci 2–4, ripening in succession, globose 8-spored, aparaphysate, sessile, 40–50μ diam. Spores conglobate, oblong with rounded ends, subopaque dark brown, 1-septate constricted, 26–32 x 14–17μ, the surface finely and closely verruculose.

39. **Cercospora capparidicola** sp. nov.

Maculae nullae; mycelium ex hyphis dilute brunneis 2–3μ crassis, septatis flexuosis, irregulariter ramosis, ex stomatibus folii parce fasciculatis emergentibus, et supra epidermidem repentibus compositum. Conidiophora dispersa singulariter, erecta brunnea simplicia recta vel leniter flexuosa, 30–50μ alt. et 4–7μ cr., 3–5-septata, superne leniter geniculata. Conidia singula terminalia filiformia brunnea 10–20-septata, haud constricta, 60–150 x 5–6μ, sursum gradatim attenuata, apuce rotundata, basi hilo atro plano prominulo praedita; exosporio minute atro-granuloso.

Hab. in foliis *Capparidis sepiariae*, Nandi, Mysore, 18.11.1944, *Thirumalachar*.

The fungus causes no definite leafpots, but forms a dark effuse thin mould over irregular patches of the lower surface of the leaf, consisting of the surface creeping hyphae, emergent in small fascicles through the stomata, and scattered single erect conidiophores. The surface mycelium consists of flexuous septate pale brown hyphae 2–3μ thick, from which the conidiophores arise as erect branches, 30–50μ high by 4–7μ thick, 3–5-septate, brown, simple, straight or slightly flexuous, somewhat geniculate

above. The conidia are single and terminal on the conidiophore, filiform, brown, 10–20-septate, not constricted, 60–150 x 5–6μ, gradually attenuated upwards to the rounded apex, and at the base with a flat black slightly projecting hilum; the surface is minutely dark granulose.

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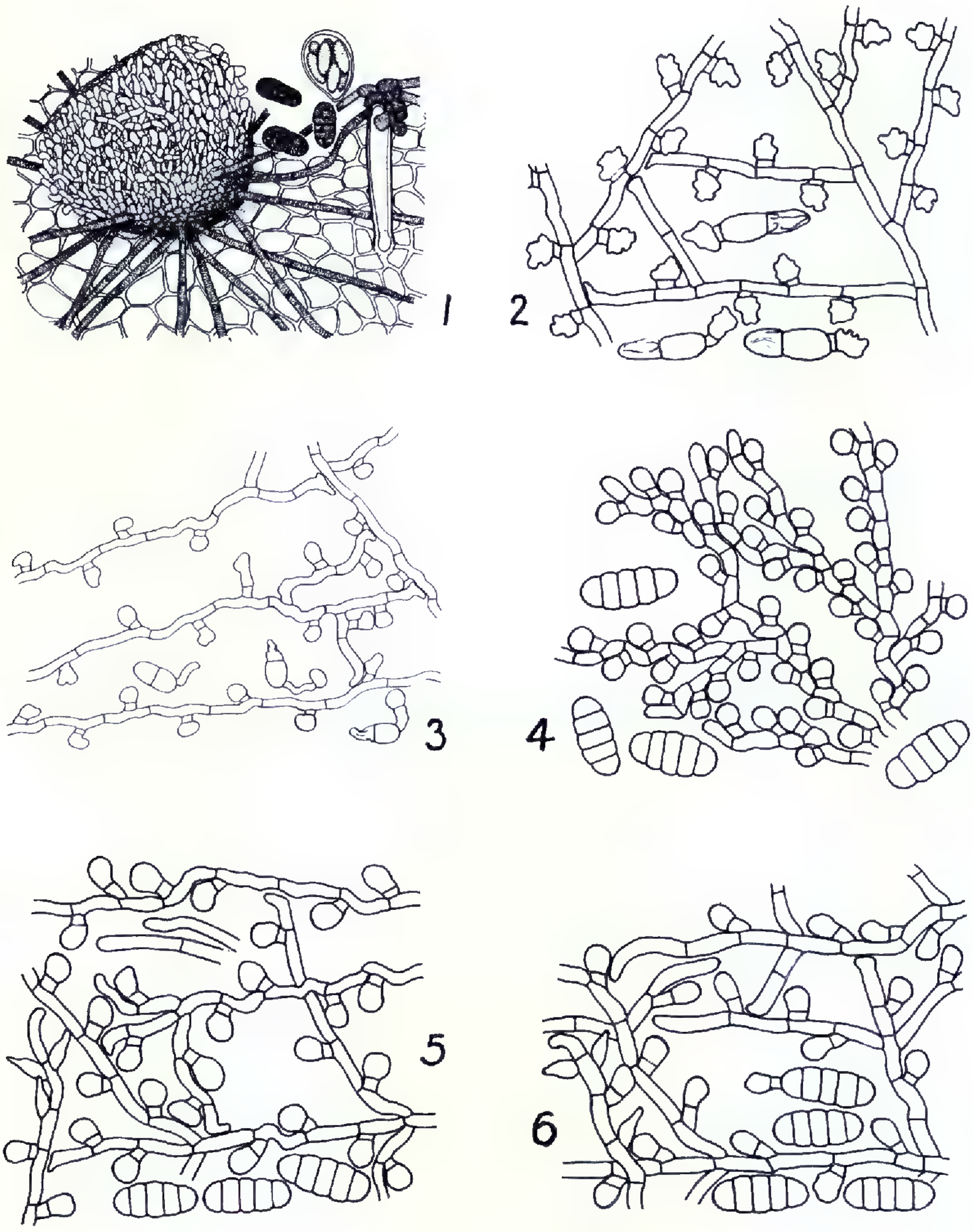
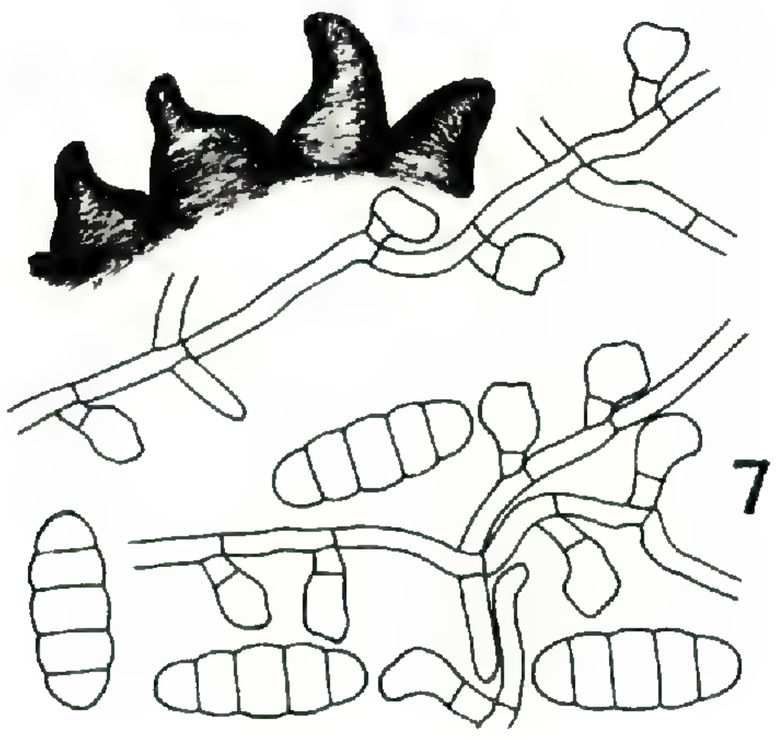
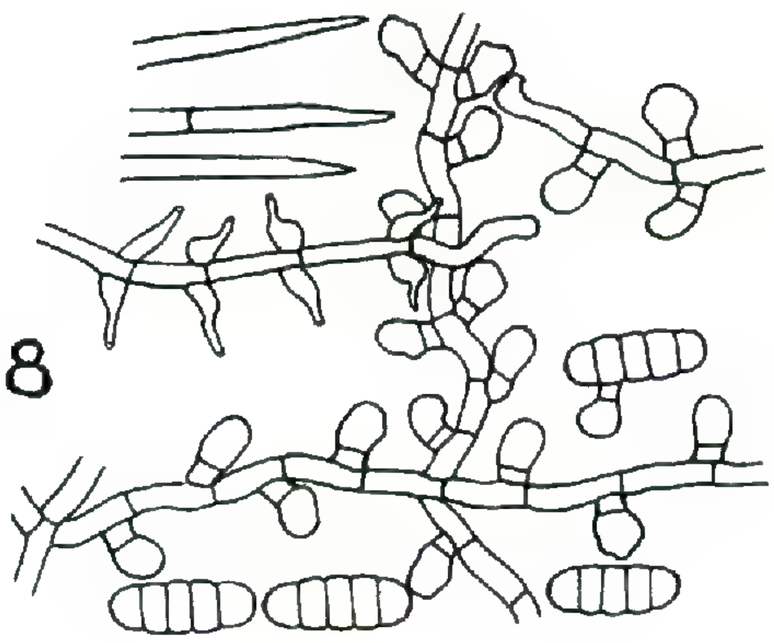
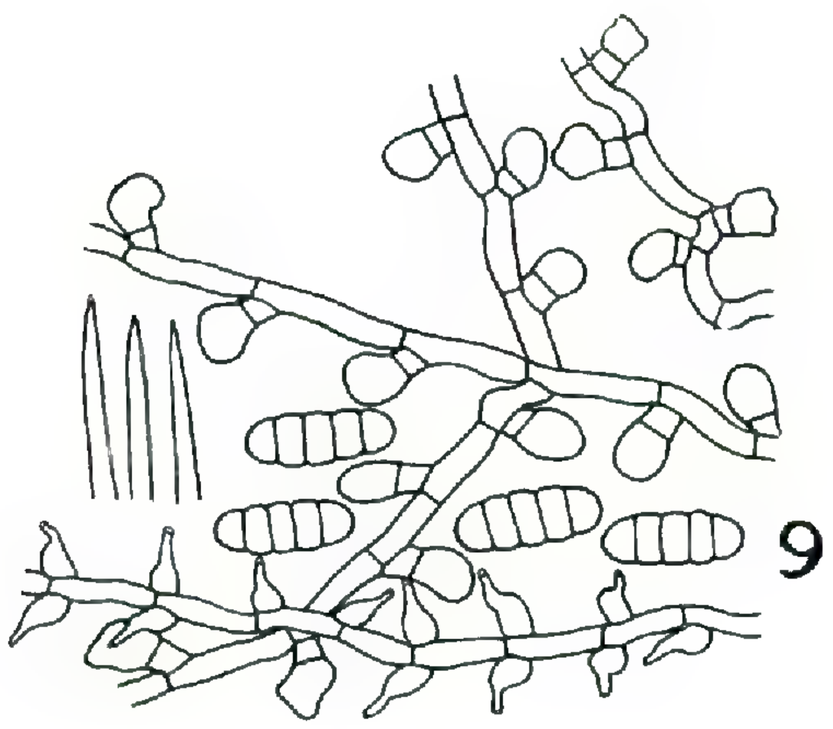
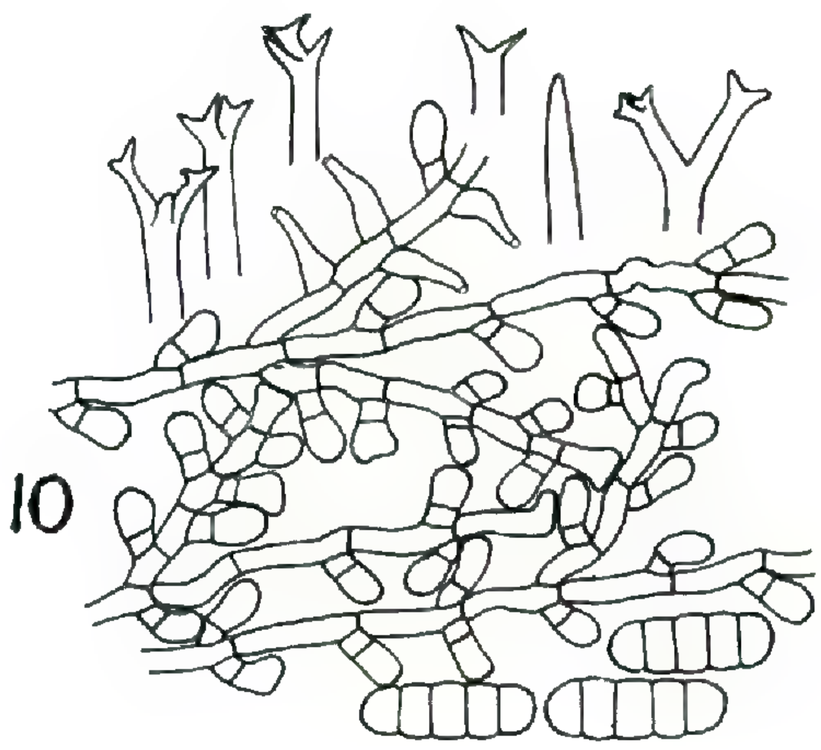


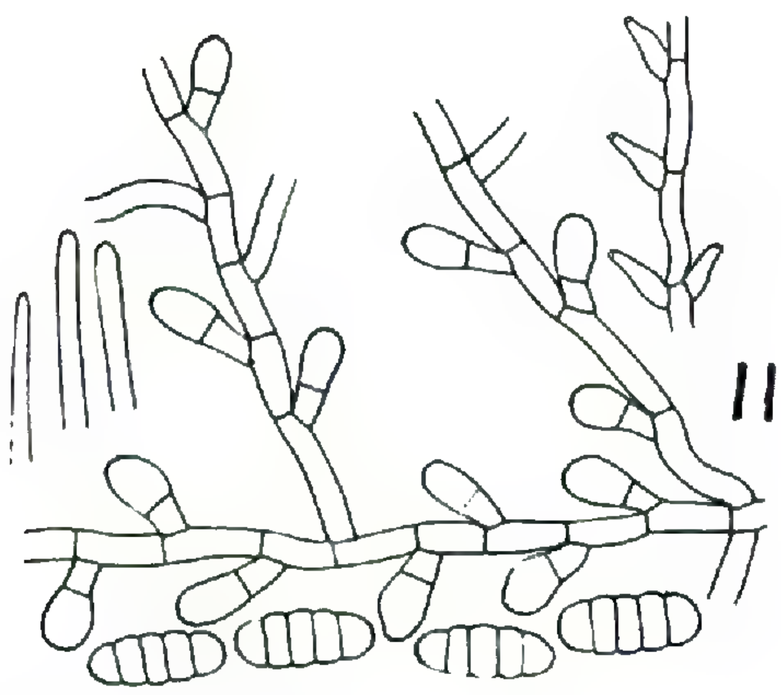
Fig. 1–6. All × 250. **1,** *Dictyonella Alangii.* **2,** *Armatella Litseae.* **3,** *A. Cinnamomi.* **4,** *Amazonia Leeae.* **5,** *Irenopsis mysorensis.* **6,** *Irenina Pothodis.*











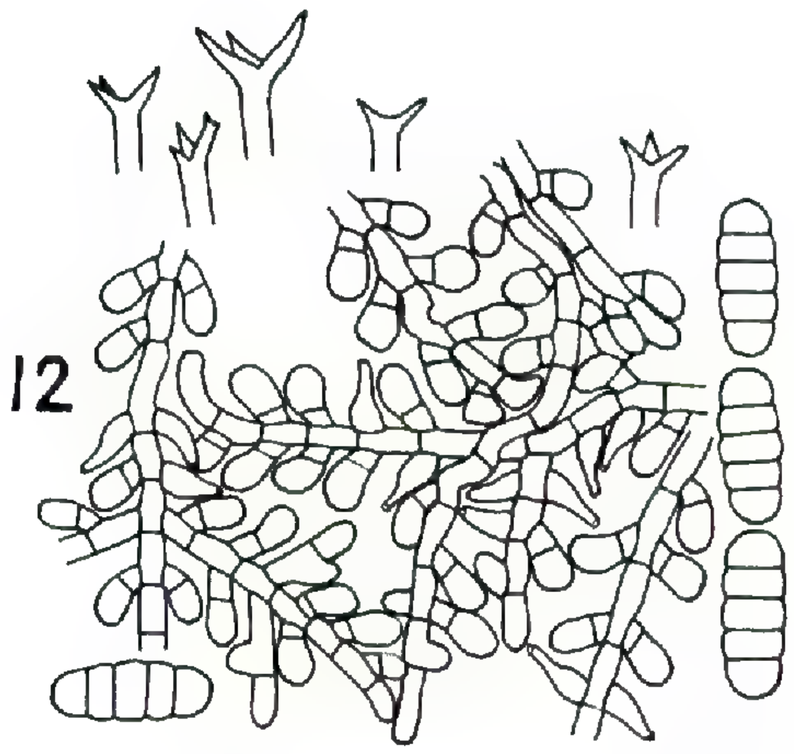
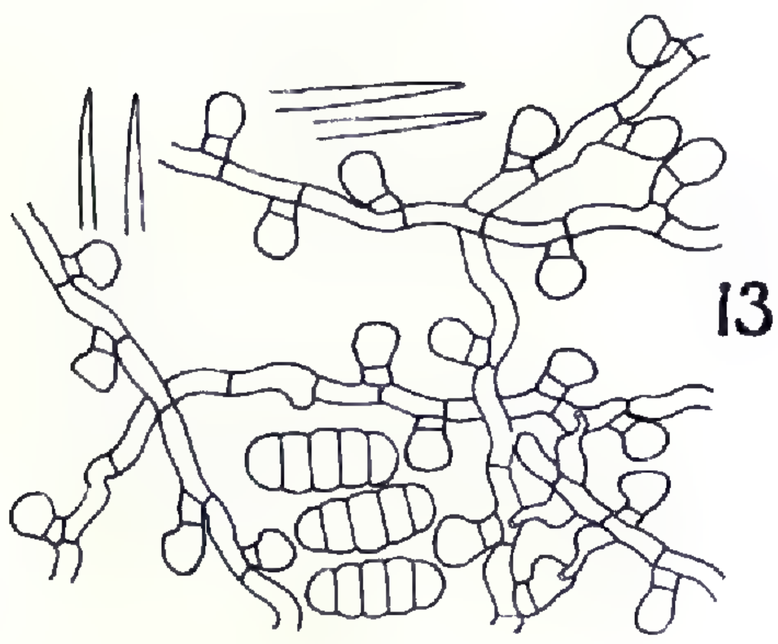
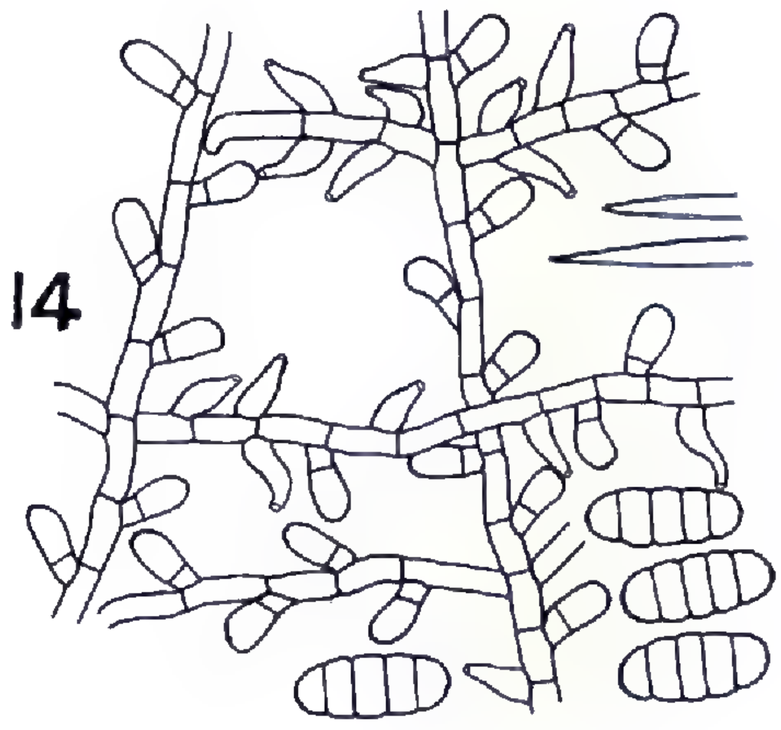
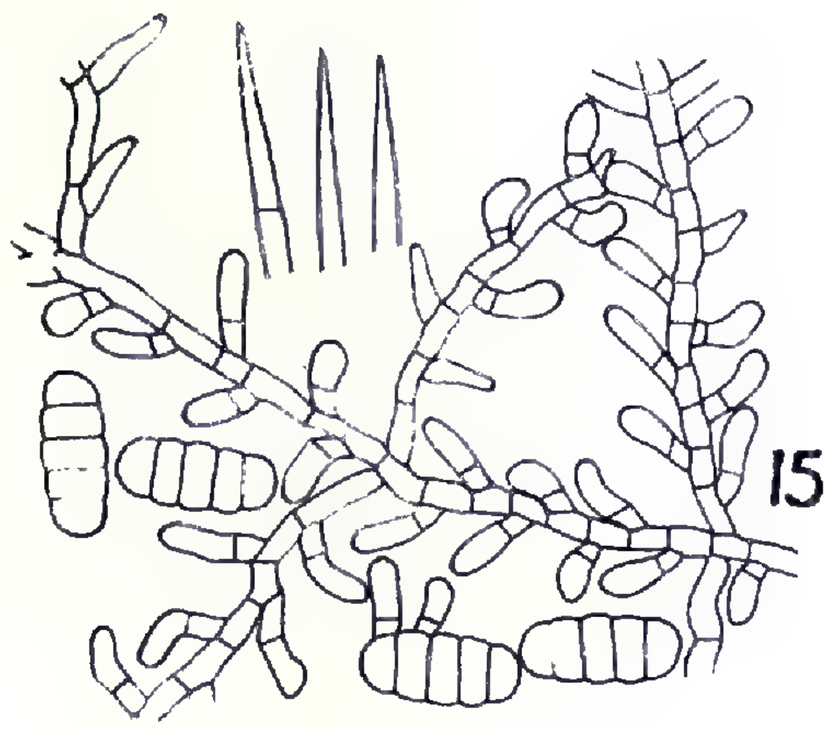
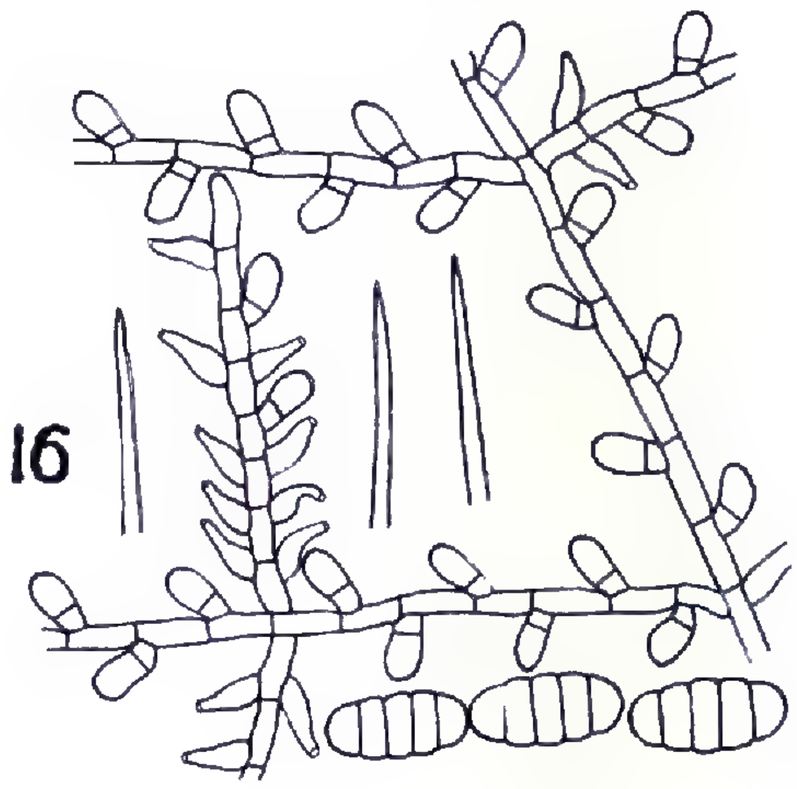


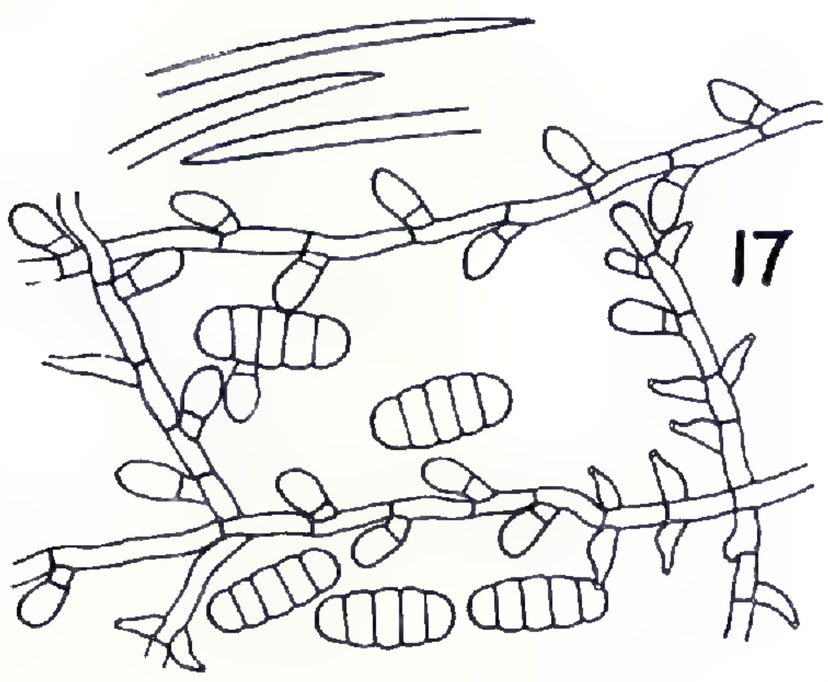
Fig. 7–12. All outlines × 250. **7,** *Irenina Malloti.* **8,** *Meliola Bakeri.* **9,** *M. bangalorensis.* **10,** *M. Cansjerae.* **11,** *M. cissampelicola.* **12,** *M. Dichapetali.*











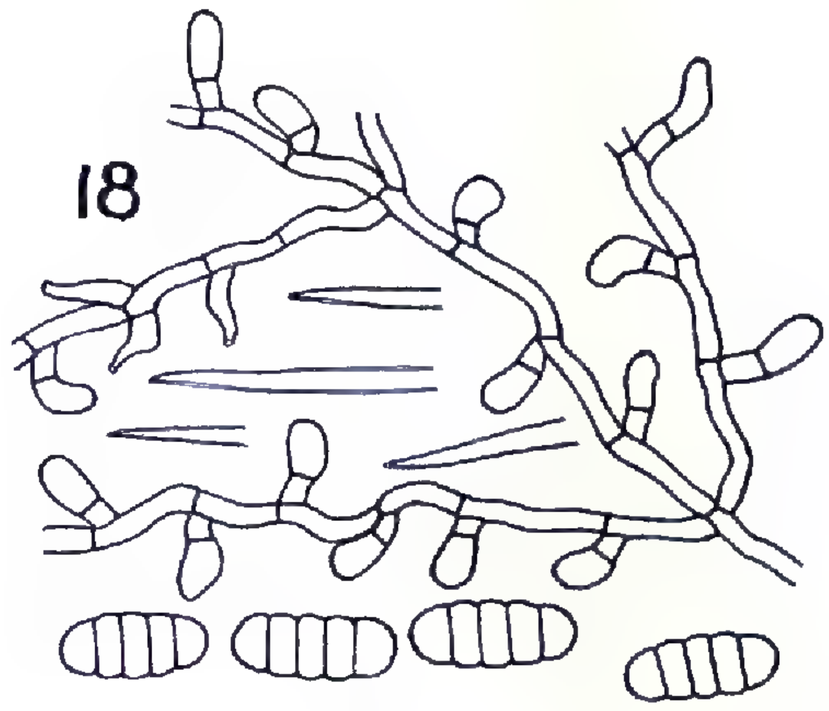
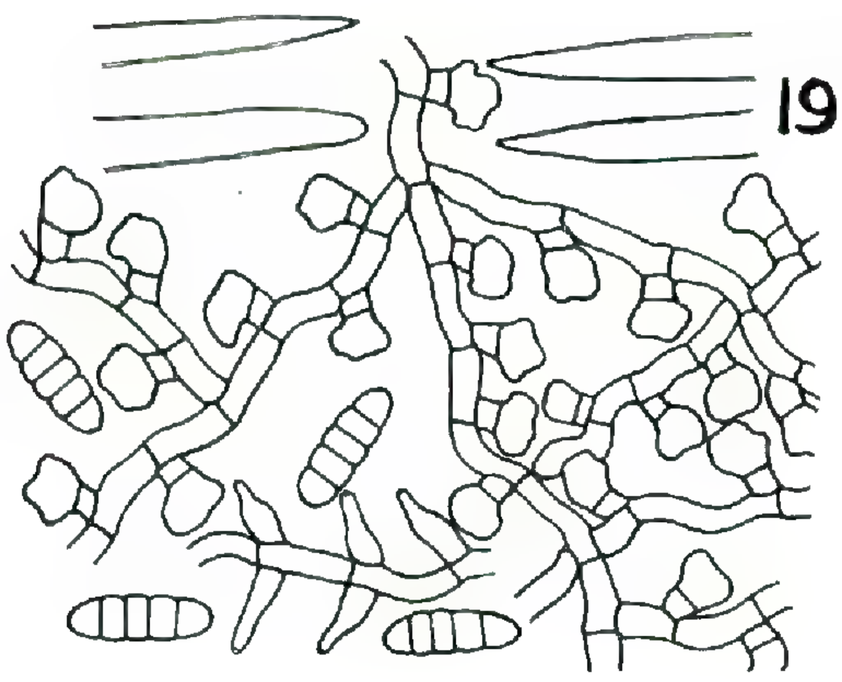
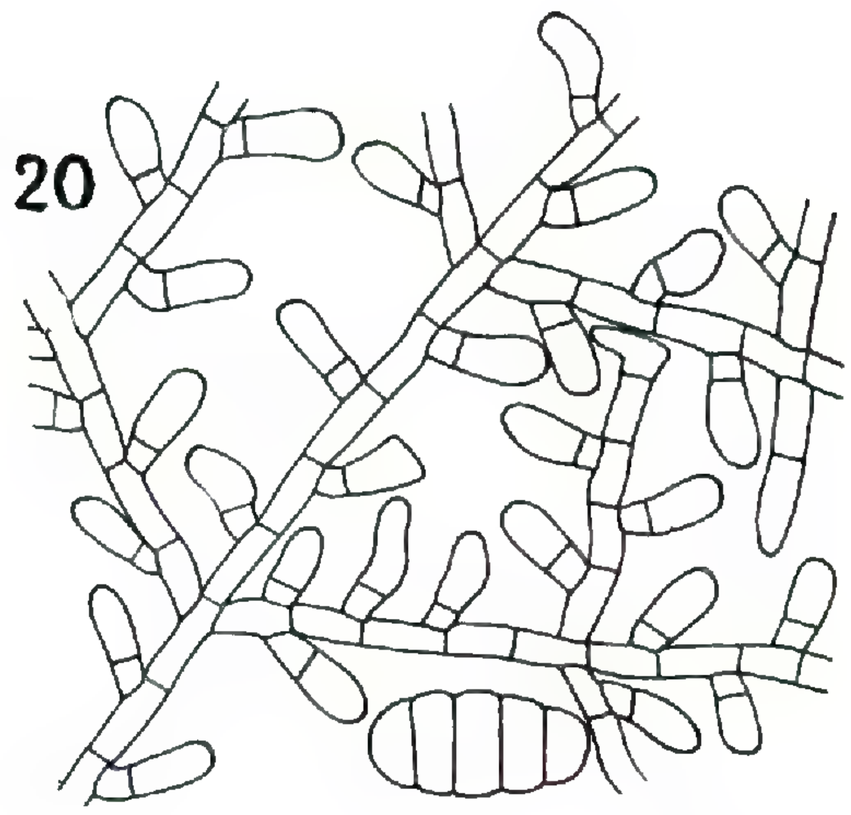
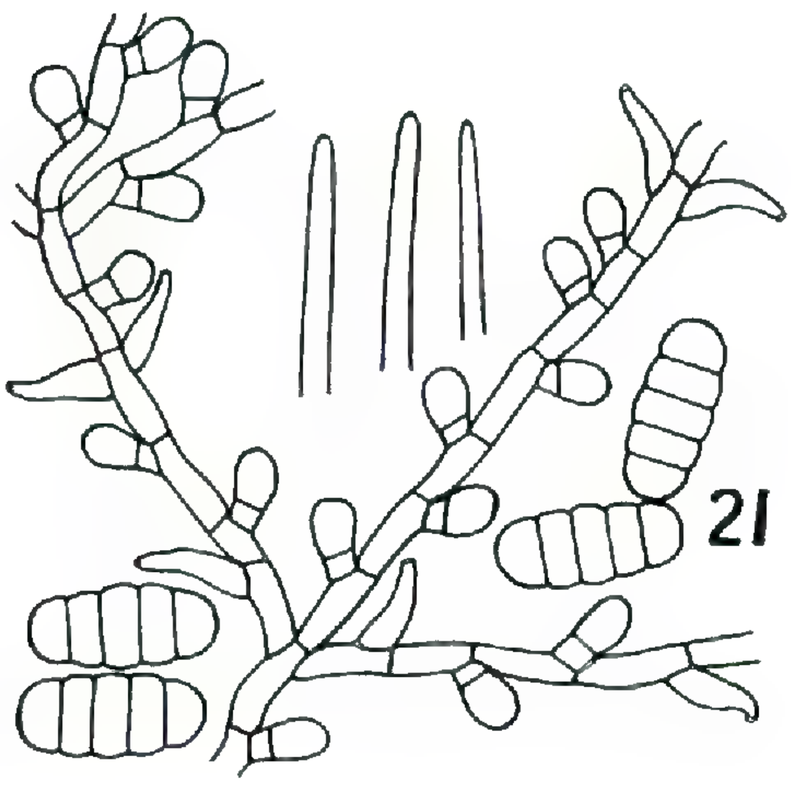
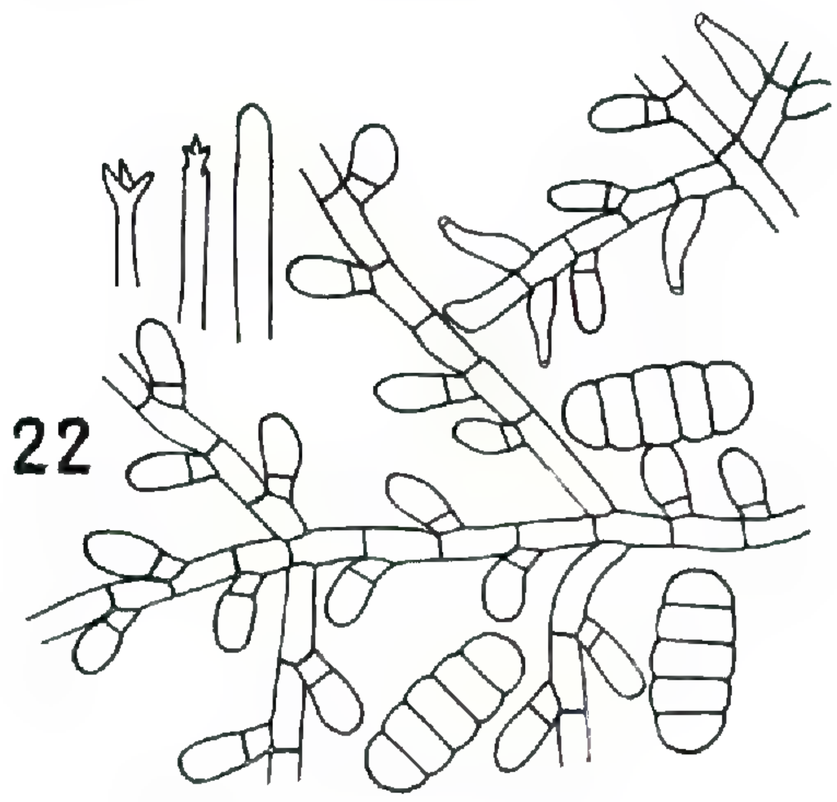


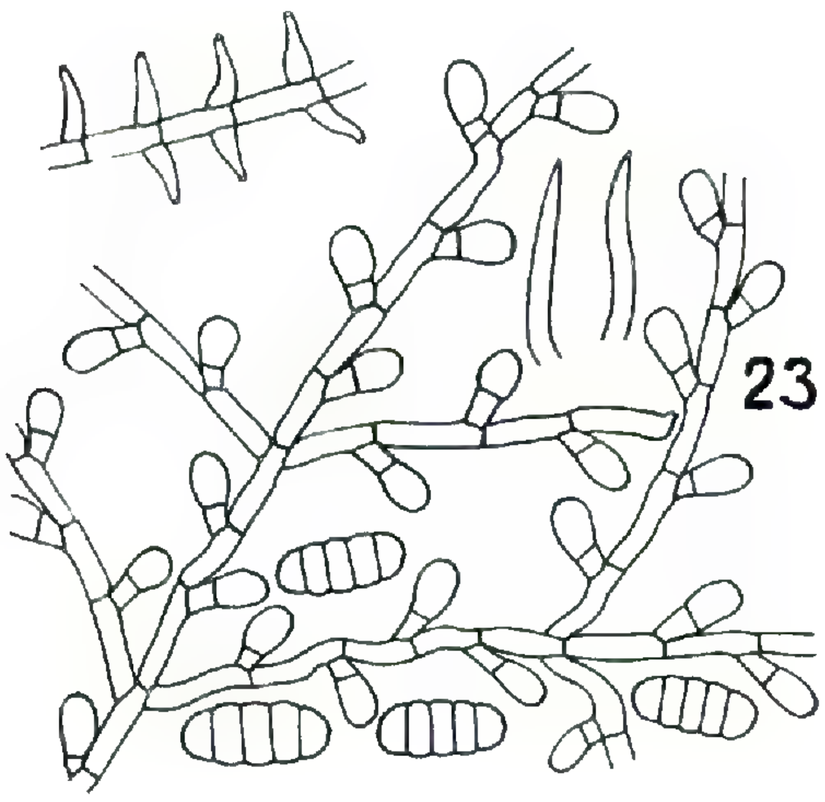
Fig. 13–18. All × 250. **13,** *Meliola Eleagni.* **14,** *M. ficicola.* **15,** *M. Gardneriae.* **16,** *M. Heyneae.* **17,** *M. Holarrheniae.* **18,** *M. Ichnocarpi.*











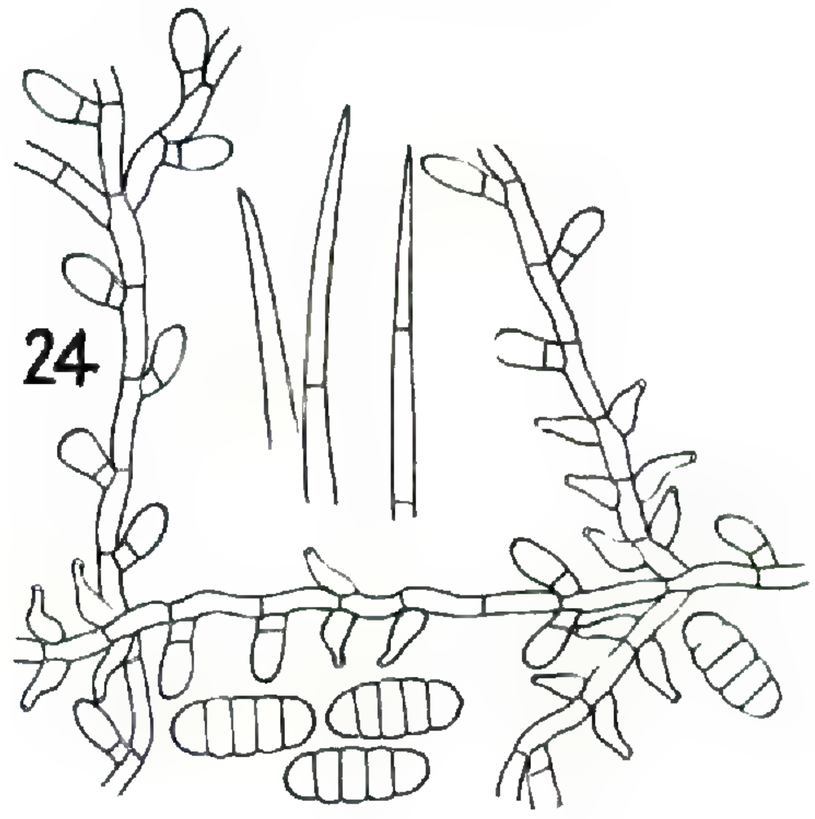
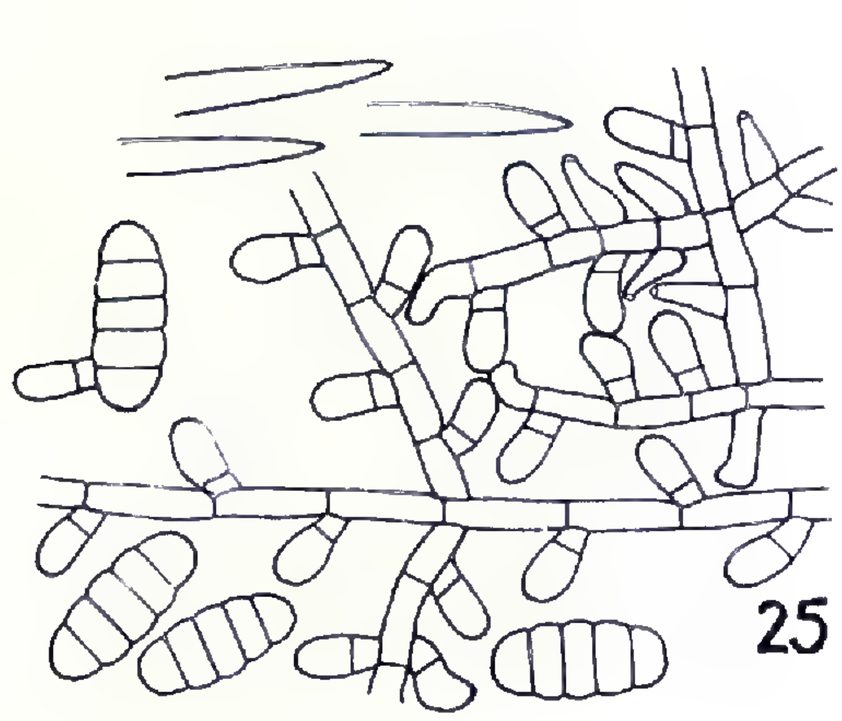
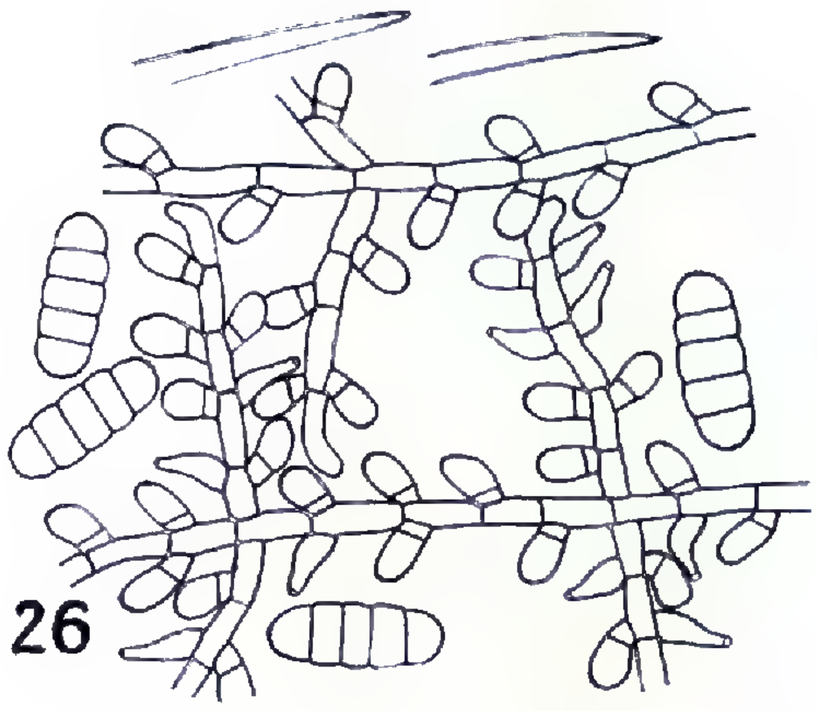
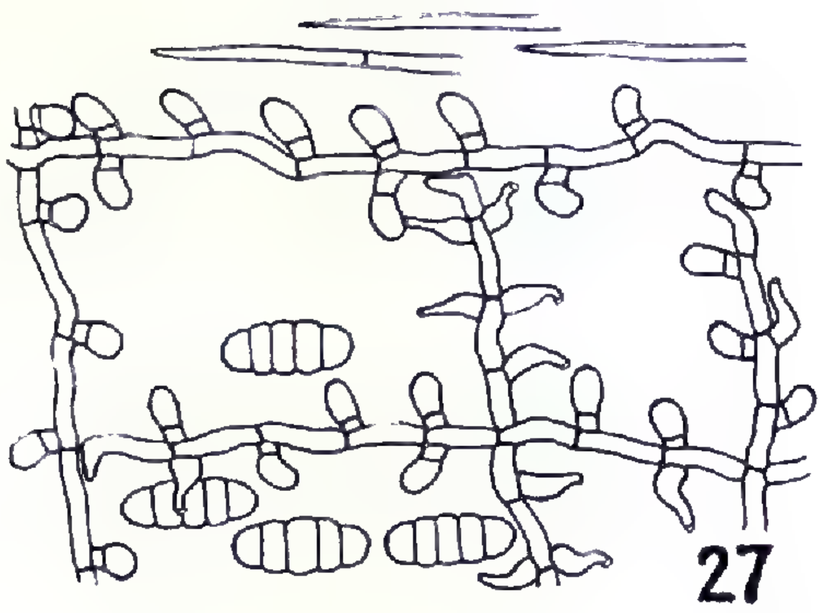
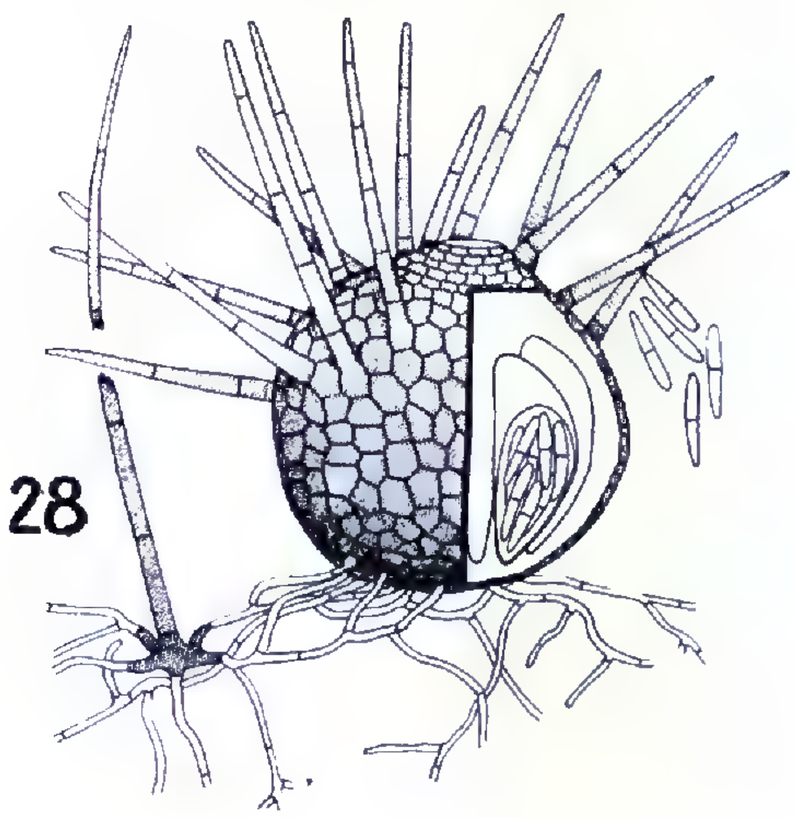


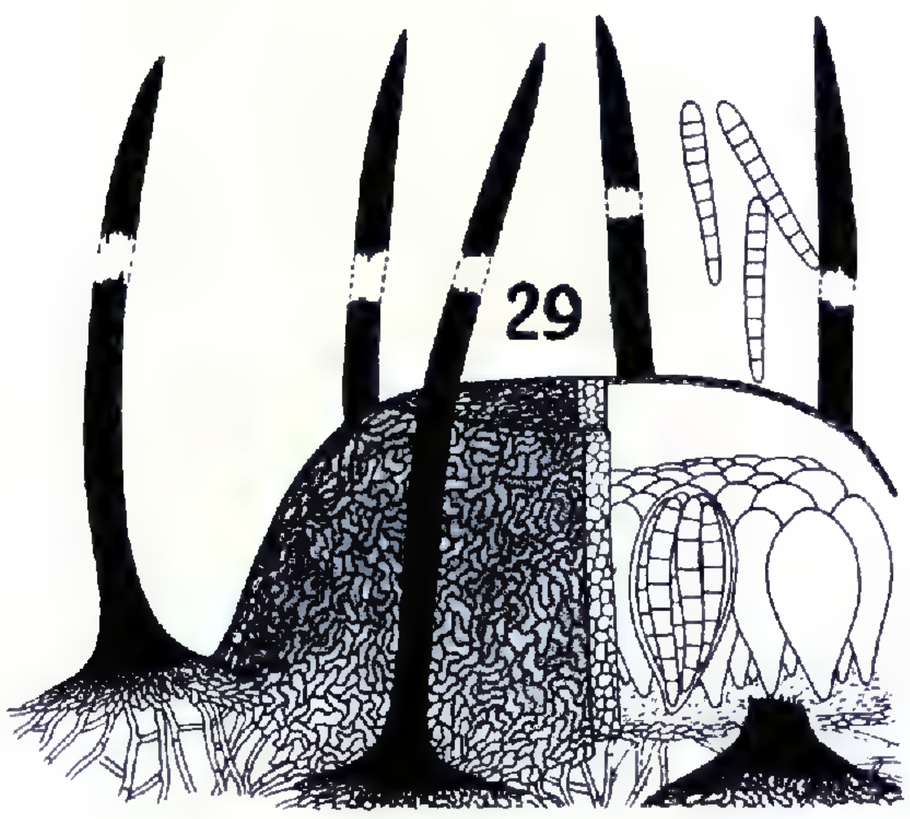
Fig. 19–24. All × 250. **19,** *Meliola Kydiae-calycinae*. **20,** *M. Mangiferae*. **21–22,** *M. Memecyli*. **23,** *M. ovatipoda*. **24,** *M. tabernaemontanicola*.











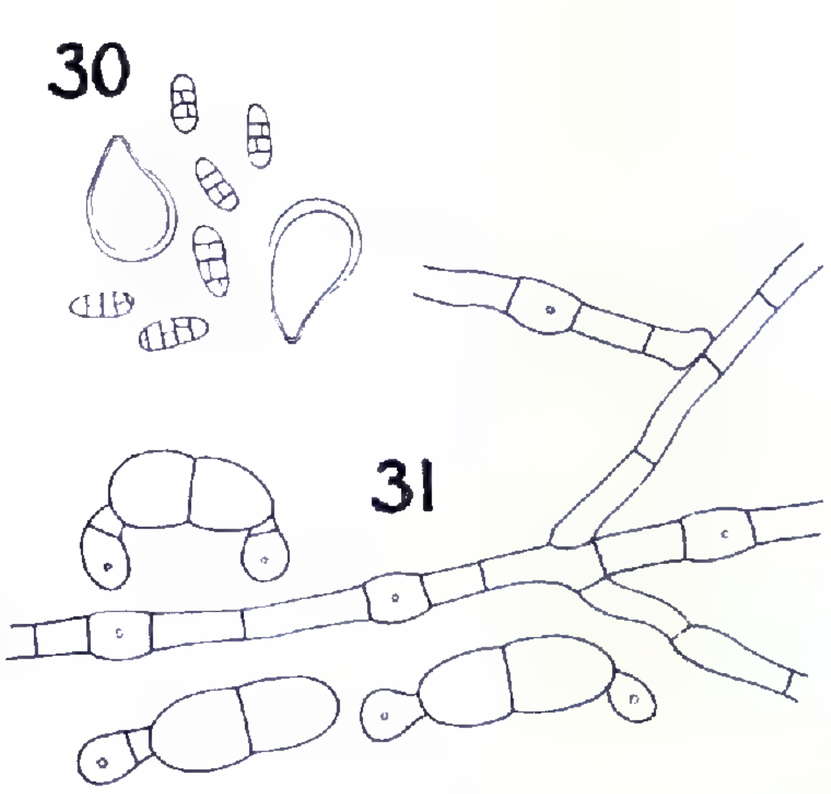
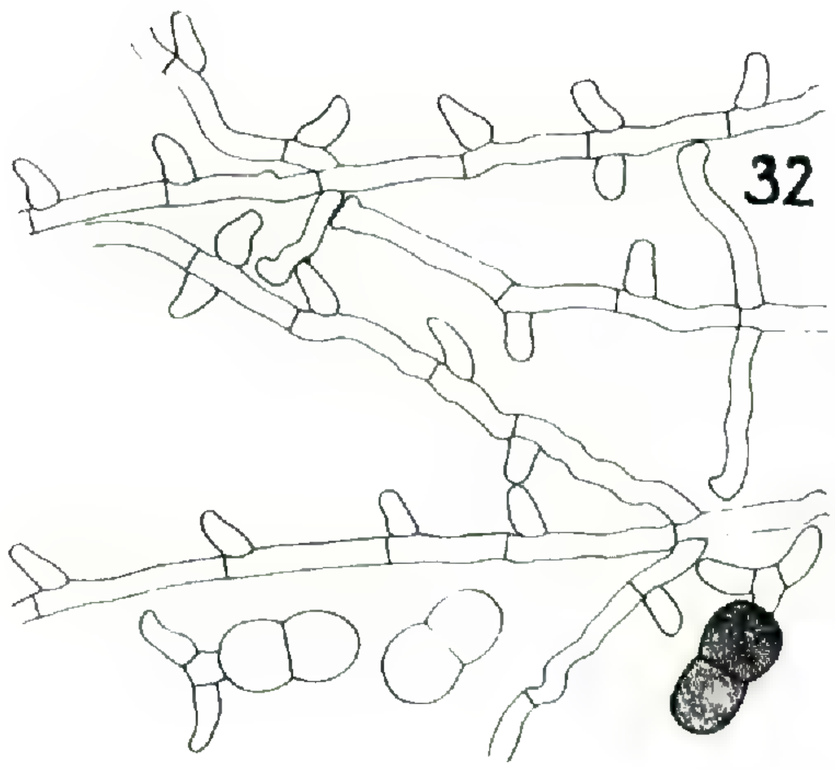
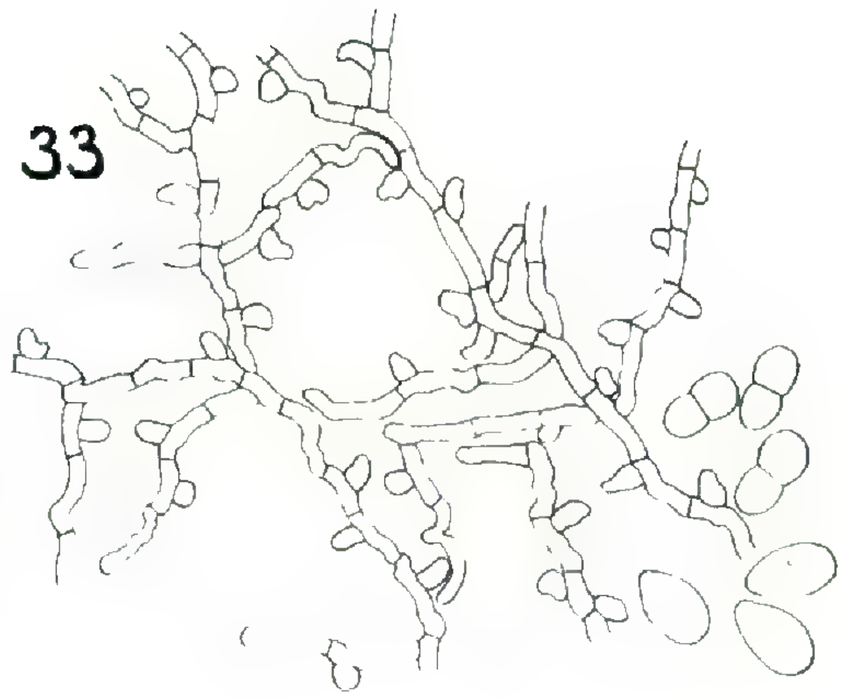
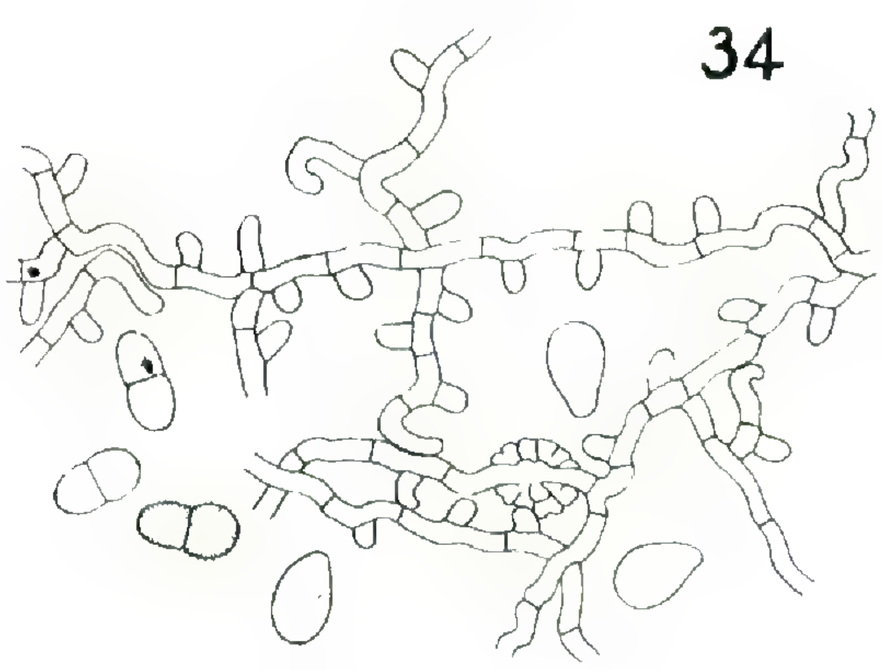
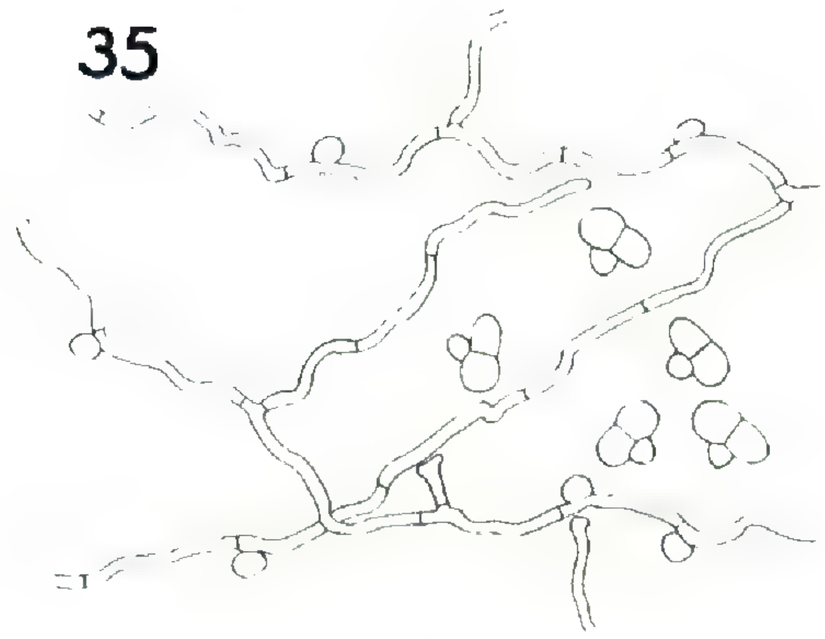


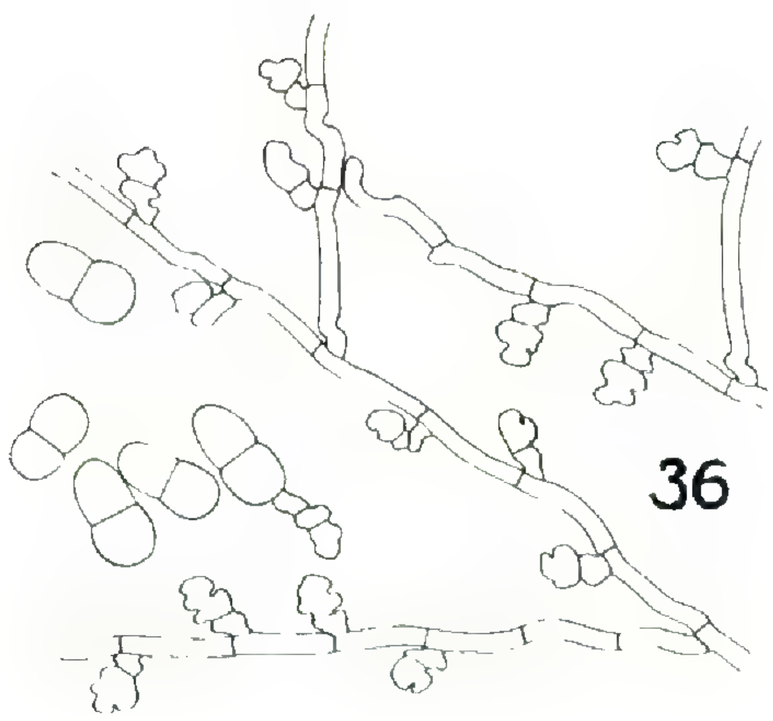
Fig. 25–31. All × 250. **25,** *Meliola Tecleae* var. *Toddaliae-asiaticae*. **26,** *M. toddalicola* var. *indica*. **27,** *M. Zizyphi*. **28,** *Dimeriella Salaciae*. **29,** *Chaetothyrium mysorensis*. **30,** *Stephanotheca Oleae*. **31,** *Asterolibertia Mangiferae*.











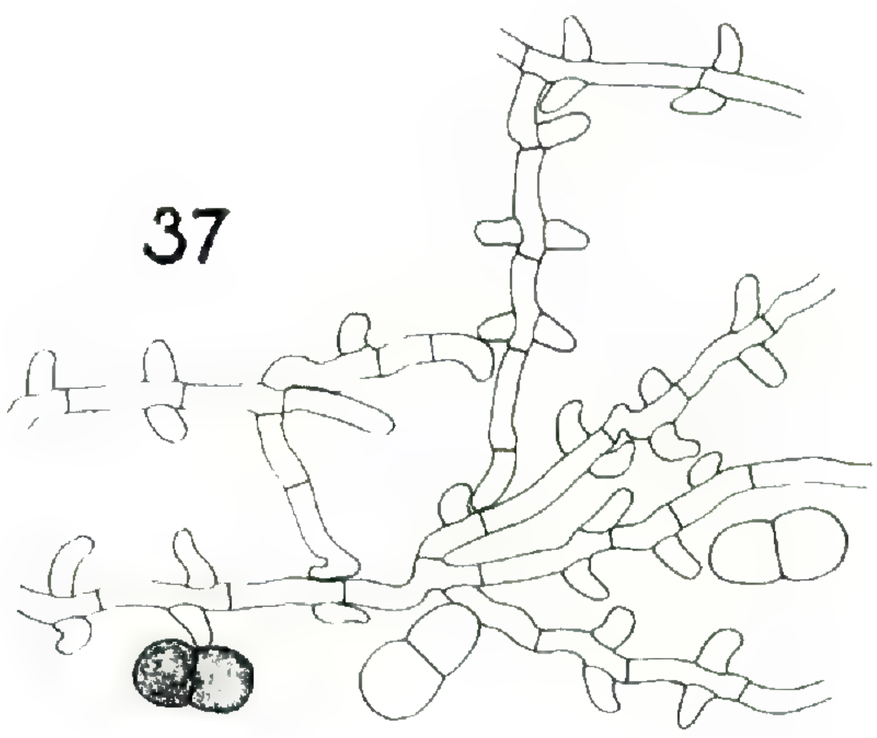


Fig. 32–37. All × 250. **32,** *Asterina cansjericola*. **33,** *A. congesta*. **34,** *A. Dichapetali*. **35,** *A. Eleagni*. **36,** *A. erysiphoides*. **37,** *A. mysorensis*.

3(3):315–326 FARLOWIA JULY, 1948

VARIABILITY AND PERITHECIUM PRODUCTION IN A HOMOTHALLIC FORM OF THE FUNGUS, HYPOMYCES SOLANI [1]

SHUH-WEI HWANG

With the isolation in 1944 of a homothallic form of *Hypomyces solani* (Rke. et Berth) Snyder et Hansen from the stem of banana, *Musa paradisiaca* L. imported from Mexico, an opportunity was afforded to compare its variability with that of heterothallic forms of the same species which have been previously studied by others (4,6). This homothallic isolate, although apparently a saprophyte on the banana, has as its imperfect stage *Fusarium solani*, a species which contains both saprophytic and parasitic forms (8).

Ascosporic variants were obtained by Dimock (1, 2, 3, 4) from *Hypomyces ipomoeae* (Hals.) Wr. (*H. solani*) by hybridization and by culturing the organism in a medium which contained sublethal concentrations of zinc nitrate. Dimock's fungus was a heterothallic saprophyte obtained from sweet potato, *Ipomoea batatas* Lam., whereas that studied by Hansen and Snyder (6) was a heterothallic form parasitic on squash, *Cucurbita pepo* L.

CULTURAL CONDITIONS AND PROCEDURES

In an attempt to obtain uniform and genetically pure inoculum, the single spore isolation method of Hansen and Smith (5) was used. A dilute spore suspension was poured on a 3% plain agar plate and the excess water drained off. Over night, spores left on the plate put out one or more germ tubes of considerable length. Under the dissecting microscope, the germinating spore body was readily cut out with a sterilized steel needle and transplanted to a potato dextrose agar slant.

The method described above was applied to ascospore as well as to conidium transfers except that the ascospores were checked under the compound microscope before transplanting them from plate to tube. However, the preparation of ascospore suspensions required special technique. Spores for this purpose could be obtained in two different ways. The most convenient way was to lift off the accumulated spore mass at the ostiole of the perithecium with a pair of sterilized forceps or with a needle. The spore mass was then dispersed in the water blank. If a spore mass was not available at the mouth of the perithecium a perithecium was picked up from the culture medium, washed with a few changes of sterilized water to eliminate

[1] Portion of a thesis submitted to the Graduate Division, University of California, in partial satisfaction for the degree of Doctor of Philosophy, June, 1946. The writer gratefully acknowledges the advice and criticisms offered during the course of the investigation and in the preparation of the manuscript by Professor H. N. Hansen and Professor William C. Snyder.

conidia that might be adhering to the perithecial wall, and placed in a drop of water on a flamed slide. A blunt steel needle applied to the perithecium forced ascospores out from the ostiole or from the cracked wall of the perithecium. This small drop of spore suspension was washed off the slide on to a plain agar plate. The rest of the procedure from this point on follows that described above.

All of the tests were conducted under ordinary laboratory conditions unless otherwise mentioned. The cultures were so arranged on tables as to receive the maximium available indirect light during the day.

OCCURRENCE OF VARIANTS AND THEIR CHARACTERISTICS

Twenty monoascosporic tube cultures were made by Dr. W. C. Snyder on potato dextrose agar from a single perithecium originally found on the banana stem. All of these monosporic cultures produced red, berry-like perithecia without requiring the introduction of conidia from a foreign compatible reaction culture and therefore were homothallic. The present studies began with one of these cultures.[2]

This original ascosporic isolate was designated the 'N' or Normal type. From it were obtained, subsequently, two types known respectively as the 'B' or Button type and 'E' or End type.

The differences between these 3 types (Plate 1) are in their gross cultural characteristics on potato dextrose agar, namely the habit and amount of mycelial growth, the pattern of the mycelial mat and the pigmentation of the cultures. These characteristics were so pronouncedly different in the 3 types, that these types could easily have been mistaken for entirely different organisms if one had not known their origin.

In some cases physiological differences were also shown. For example, some cultures produced perithecia and macrospores more readily than others. From the standpoint of cultural characteristics these 3 types remained separate and distinct, while under microscopic examination, the morphology of microspores, macrospores, chlamydospores, perithecia and ascospores on which classification is based showed no great diversity in all variants studied. Therefore the only conclusion that could be made concerning these variants was that they are manifestations of the genetic variability of a single organism.

The B type first appeared among a series of monosporic cultures of the N type. This occurred repeatedly. Further studies indicated that B either produced another type, E, which was culturally different or remained unchanged with minor modifications, namely with slight changes in pattern of the mycelial growth and in ability to produce spores and perithecia. The progenies of B therefore varied either in a direction further away from N or within the limits of the B type.

[2] An inoculation test conducted in the greenhouse demonstrated that this culture was not parasitic on squash and that it was distinct therefore from *H. solani* f. *cucurbitae*.

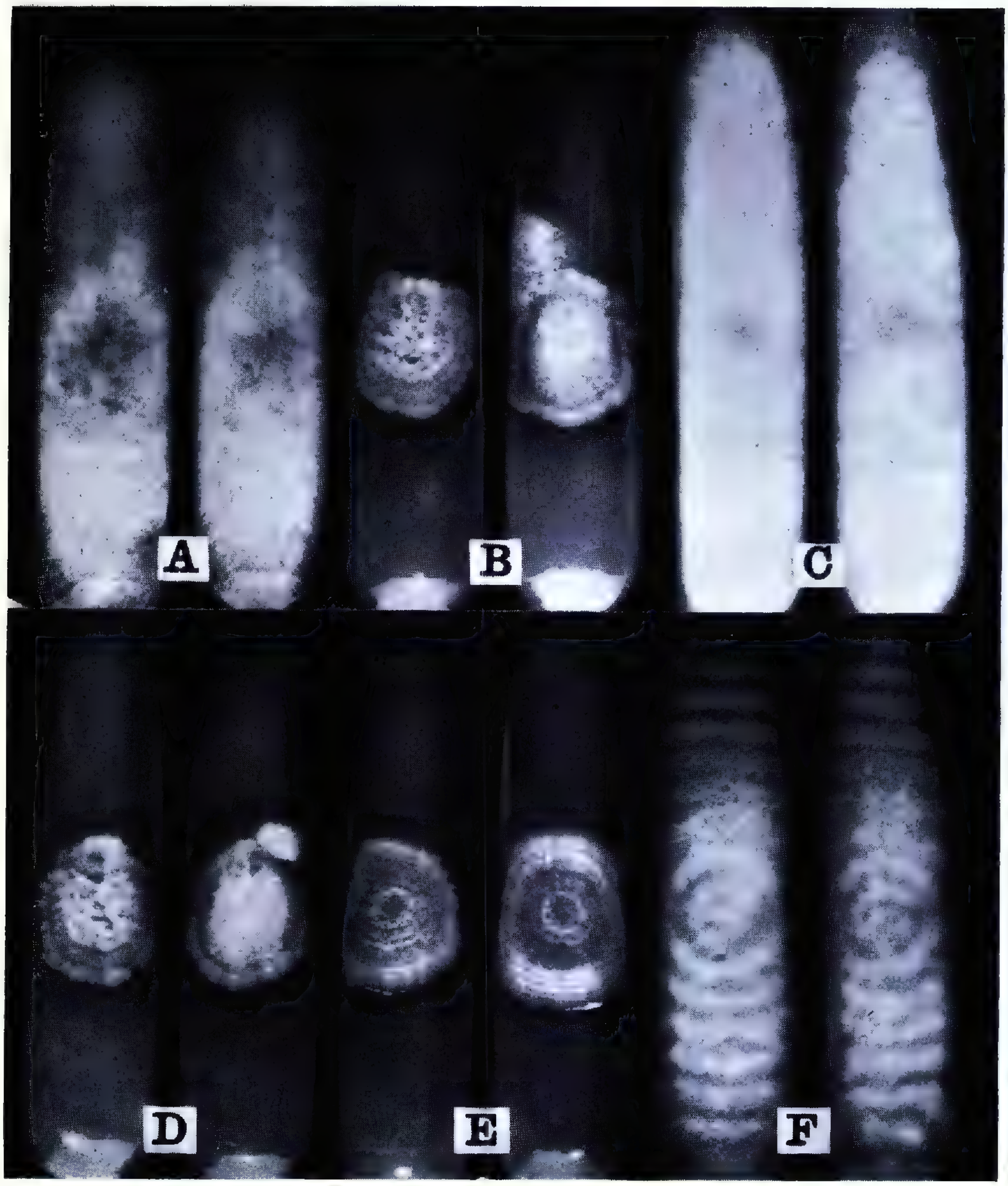
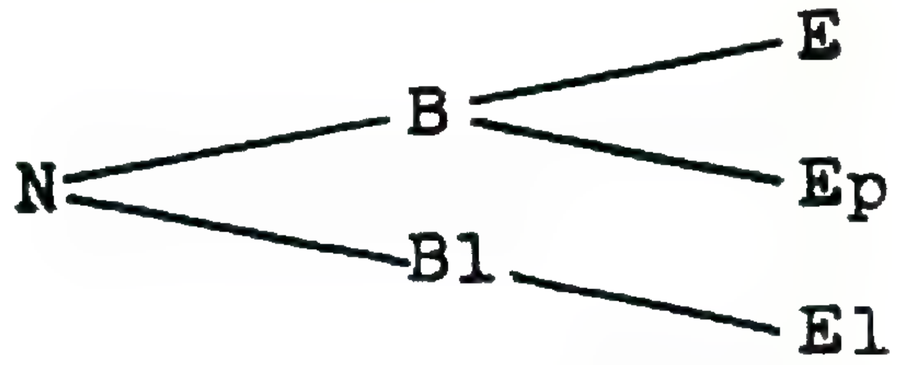


PLATE I

Comparative appearance and growth rates of 20 day old single-spore cultures, in duplicate, of *Hypomyces solani* (homothallic form) on potato dextrose agar. The types in the first chain mutation, N to B to E are represented, respectively, by A, B, and C; whereas those of the second chain mutation, B to B1 to E1 are shown, respectively, by D, E, and F.

All B types either came from N or from an already existing B and had the ability to produce the entirely different type E. One of the characteristics of E was that it no longer gave rise to variants. One B could give rise to 1 or 2 E types.

The phenomenon wherein N gave rise to B which in turn produced E is termed here a chain reaction. Two such chain reactions were revealed in the study and are illustrated in Text Figure 1.



TEXT FIGURE 1. Origin and direction of the chain mutations N to B to E, and N to B1 to E1.

Two complete reactions (Plate 1), first N to B to E and, second, B to B1 to E1 have been under close observation as outlined in the above diagram. The first series of variants was directly derived from N while the second series was from B. Minor variations within the limits of B occurred frequently, but once the fungus changed into the E type active variability ceased and it became stable. A purple modification of E, namely Ep, was occasionally obtained from B instead of the usual non-pigmented E.

1. *The normal type*, N

The so-called normal type was the original type. This was the cultural type isolated directly from nature. Its cultural characteristics differed from those of the other two types by its loose, silky, mycelial growth. Regardless of the age of the culture conspicuous conidial masses ordinarily did not appear on the mycelial mat except in one of the minor variations within N. Moderate growth of aerial mycelium resulted in a thin, smooth mat on solid medium, with a slightly grey-purple cast.

2. *The button type*, B

The prominent characteristic of the button type was its slow growth rate on potato dextrose agar and the general creamy appearance of the raised colony which suggested very much a yeast culture. Mycelial growth extended deeply into the medium and altered the texture of agar into a leathery consistency. A 5-day old culture was the size of a pea and had a smooth surface which became rough or wrinkled with age. After the colony reached the size of the diameter of the culture tube, it remained circular, hence the term 'button.' A mycelial sector or sectors sometimes appeared on the edge of the button. In this event, the rest of the agar slant soon became covered by mycelial growth, but the button still maintained its identity in the center of the colony. Altogether these characteristics were markedly different from those of the ordinary Fusarium culture, and from those of the N type from which it originated.

The majority of the cultures of this type were beige colored, at least when they were young. Violet and different degrees of purple appeared in a few cultures and some cultures gained in intensity of coloring as age advanced. Aside from pigmentation, the described characteristics of this button type were constant throughout the studies.

3. *The end type*, E.

The cultural characteristics of the E type were those commonly encountered in Fusarium. Comparatively speaking, all the variations of this type possessed thicker mycelial mats than did the normal type. In one of the subtypes, the aerial mycelium in older cultures formed a dense cotton-like layer, so thick and spongy as to provide a great capacity for water absorption. In another E type a purple pigment was present.

THE CHAIN MUTATION: N TO B TO E

1. *Mutation of N*

Monosporic cultures were made from normal (N) one and a half to three month old monosporic cultures. Among this series 5 out of 10 isolations from one tube and 2 out of 10 from another tube gave the B type. Details are given in Table 1.

TABLE 1. THE PROGENIES OBTAINED BY SINGLE SPORE TRANSFER FROM N CULTURES OF DIFFERENT AGES

Culture age in months	Spore kind	Progenies N	Progenies B	Total transfers
1½	ascospore		14	14
	conidium	15		15
2	ascospore		18	18
	ascospore		20	20
	ascospore		14	14
3	conidium	5	5	10
	conidium	8	2	10
	ascospore		11	11
Total		28	84	112

From a normal culture, one and a half months old, the monoconidial isolations developed only into the normal type while the monoascosporic isolations resulted in the button type. Monoascosporic isolations made from a single perithecium of an N culture also yielded the B type. Sixteen perithecia of different cultures of various ages were included in this analysis. The majority of them gave the B type. However, these results did not mean that a conidial culture would always give the N type nor that the ascospore cultures would always give the B type, since younger cultures yielded mostly the N type irrespective of the kind of spore transferred. They merely indicated that this B type was obtainable either by monoconidial or monoascosporic isolations from aged N cultures.

Among these 112 monosporic cultures 25% or 26 cultures were N and 75% or 84 cultures developed into the B type. The ratio may or may not be significant of any natural law governing the appearance of this B type, yet it did strongly suggest that an entirely different culture character may evolve from an N type and that the frequency of its appearance was high and predictable.

2. *Mutation of B*

The mutation of B consistently gave E. The E type was apt to appear at any point in the margin of a B culture after it was 7 to 10 days old. This happened frequently and was recorded about 50 times or more in monosporic cultures of the B type.

The E type could also be isolated by the single spore method from B type cultures in which there was no sign of E. Often as high as 50% of the single spore sub-cultures from B were the pure E type. Therefore monoconidial and monoascoporic transfers from the B type fell into two distinct classes; either B or E. This is demonstrated by the following table.

TABLE 2. TYPES OBTAINED IN SINGLE SPORE SUB-CULTURES FROM B CULTURES

Culture age in months	Spore kind	Progenies B	Progenies E	Total transfers
1	ascospore	6	0	
	conidium	6	0	12
1½	ascospore	0	3	
	conidium	1	2	6
	ascospore	0	3	
	conidium	2	1	6
	ascospore	0	3	
	conidium	3	0	6
2	ascospore	0	6	
	conidium	6	0	12
2½	conidium	3	0	3
	ascospore	1	2	
	conidium	0	3	6
	ascospore	0	3	
	conidium	0	3	6
	ascospore	0	3	
	conidium	3	0	6
Total		31	32	63

There was obtained from B a subtype of E designated as Ep which was stable and differed from E only in its production of a bright deep purple color in the agar.

3. *Constancy of E*

When E cultures were about one month old, monosporic cultures were made both from regions of the button proper and from the E sector in the

same tube. These monosporic cultures fell into two categories; either a button type or an end type. The results of this test are summarized in Table 3.

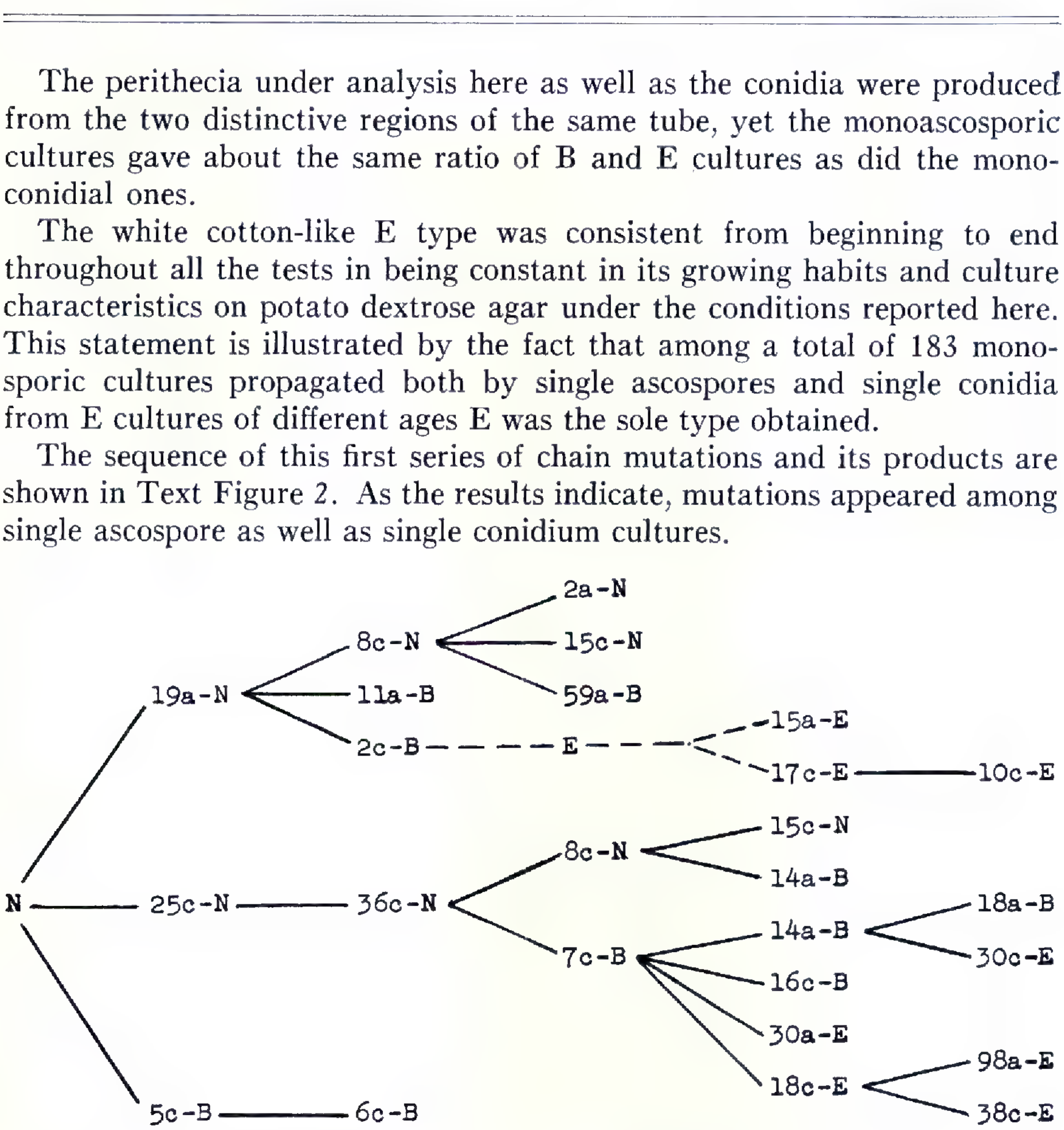
TABLE 3. SINGLE SPORE PROGENIES FROM A B CULTURE CONTAINING AN E SECTOR

Culture age in days	Spore kind	Progenies B	Progenies E	Total transfers
24	conidium	14	14	28
24	"	17	6	23
25	"	8	7	15
42	ascospore	14	18	32
	conidium	16	16	32
Total		69	59	128

The perithecia under analysis here as well as the conidia were produced from the two distinctive regions of the same tube, yet the monoascosporic cultures gave about the same ratio of B and E cultures as did the monoconidial ones.

The white cotton-like E type was consistent from beginning to end throughout all the tests in being constant in its growing habits and culture characteristics on potato dextrose agar under the conditions reported here. This statement is illustrated by the fact that among a total of 183 monosporic cultures propagated both by single ascospores and single conidia from E cultures of different ages E was the sole type obtained.

The sequence of this first series of chain mutations and its products are shown in Text Figure 2. As the results indicate, mutations appeared among single ascospore as well as single conidium cultures.



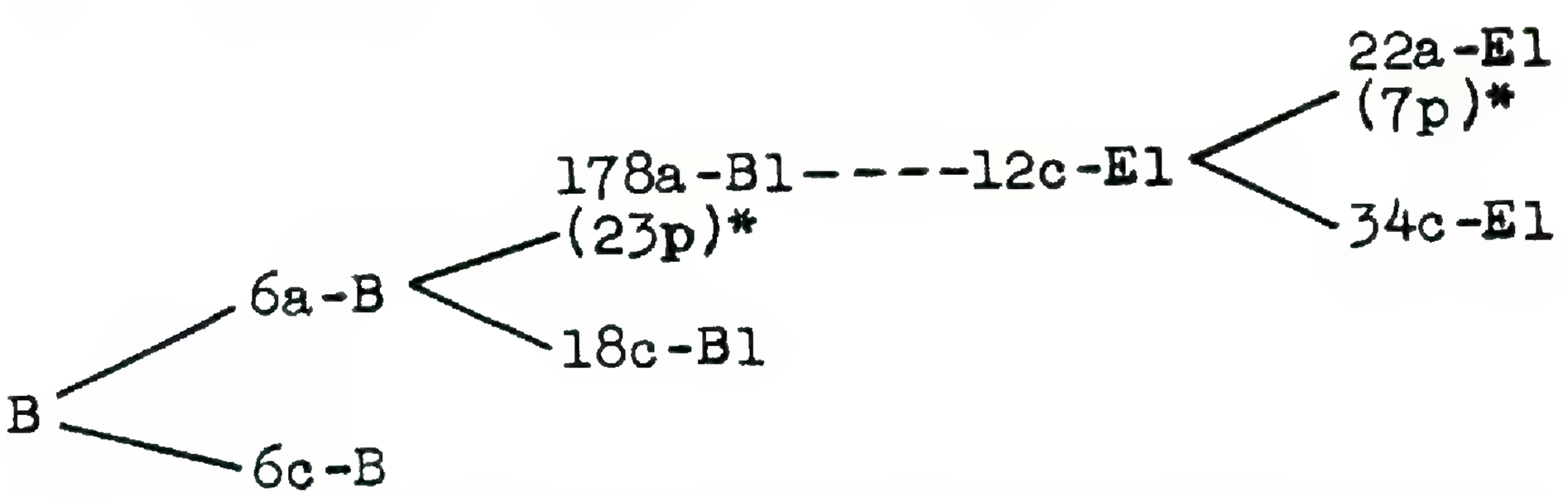
TEXT FIGURE 2. Sequence and number of mutations yielding B and E obtained from N by single spore transfers of conidia (c) and ascospores (a). The dotted line indicates that transfers were made from a sector.

THE CHAIN MUTATION: B TO B1 TO E1

In this second chain mutation, B1 differs from B in its heavy production of macrospores on the young culture. Also, later on, numerous red perithecia color the whole colony proper of B1 so abundantly that they give the culture a rusty appearance. The first appearance of B1 was found among monoascosporic cultures of B. An E1 variant was isolated by single spore sub-cultures which resembled B1 in the heavy production of macrospores and perithecia, but on account of its thick mycelial mat and its constancy was grouped with the E type. The aerial mycelium of E1 was not pure white but somewhat brownish and showed distinct concentric rings which E did not have. The essential difference between E and E1 was just the difference between B and B1, that is the excessive production of macrospores and perithecia, a condition which suggests a link between the E1 variant and original B1. It is also indicated that if variation occurred within the B limits, the variability continued to take place until an E type was produced.

The tests made on this series are summarized in Text Figure 3.

The incidence of the E1 type sector in a B1 culture was low in comparison to the incidence of the E sector in a B culture.



TEXT FIGURE 3. Sequence and number of mutations yielding B1 and E1 obtained from B by single spore transfers of conidia (c) and ascospores (a). The dotted line indicates that transfers were made from a sector of B1. The asterisk (*) indicates the number of perithecia under examination.

INFLUENCE OF FLOODING OR SPRAYING CULTURES ON PERITHECIUM FORMATION AND HYBRIDIZATION

That hybridization in a homothallic fungus such as *H. solani* is possible has been reported by Hwang et al. (7) who showed that E1 could be recovered by monoascosporic transfer from perithecia of N after N cultures had been flooded or sprayed with a spore suspension of E1. Not only have these results demonstrated that E1 was a true mutation but that this procedure offers an additional tool for the study of the genetics and inheritance within homothallic ascomycetes of this kind. It was also shown that perithecium production could be increased by flooding or spraying full grown cultures with sterile water.

EFFECT OF LIGHT ON PERITHECIUM PRODUCTION

That light favors perithecium production in some ascomycetes has been shown for the heterothallic parasitic fungus *H. solani* f. *cucurbitae* (9). Experimental results show that this is also true for the homothallic saprophyte, *H. solani.* Two sets each of test tube cultures of B and B1 were prepared. One set was kept in the dark, but placed side by side with the other set on a laboratory table. B1 and B were chosen because they possess contrasting abilities for perithecium production.

In the set subjected to light, perithecia appeared after 20 days in cultures of B1, and no perithecia had formed in B cultures. However, a month later a few perithecia were present in the B cultures, and the B1 slants were heavily covered with red fruiting bodies. Nothing had showed up on either B or B1 cultures in the dark. However, one week after the culture tubes in the dark were exposed to light, perithecia developed on both B and B1. A few appeared in cultures of the former type and large numbers in those of the latter. This shows that light is one of the factors necessary for the initiation and maturation of perithecia.

FRUCTIFICATION ON POTATO DEXTROSE MEDIUM

Observations were made on the relative abundance of the conidial and perithecial stages in cultures of the N, B, B1 and E type on potato dextrose agar after periods of 1, 2 and 6 weeks. All cultures were exposed to light during these periods. A summation of the results are as follows.

Microconidium production in the N type was more abundant than that of either macrospores or perithecia. Perithecium production was as weak as in B, which was poor in all kinds of sporulation. Macrospores were more plentiful in N than in B. The variant B1 obtained from B showed extraordinarily high productive ability for macrospores and perithecia. Microconidium production in E1, which was derived from B1, was as vigorous as in B1. If the members of the first chain reaction are compared by themselves then E has greater sporulating power than either N or B in respect to all three different kinds of fructifications.

AGING AND VARIATION

Cultures used in this study were a single tube each of N, B, and E. Conidia for single spore transfer were removed from one of four spots equidistant from the initial inoculum on these slants at intervals of one month by a moistened sterilized wire loop. However, owing to the low ability of B to sporulate, 4 tubes of it were prepared at the same time at the beginning of the experiment. In order to secure sufficient spores for spore suspensions a whole slant of B was washed with a water blank each month.

The outstanding fact shown in Table 4 is the constancy of E, when tested under different environmental conditions at various ages. But the incidence of variation in B was shown to decline with age while it increased in N.

TABLE 4. INCIDENCE OF MUTATION IN CULTURES OF N, B, AND E AS DETERMINED BY MONOCONIDIAL TRANSFERS MADE FROM CULTURES 1, 2, 3, AND 4 MONTHS OF AGE

Culture age	Progenies of N				Progenies of B				Progenies of E			
in months	N	B	Total	%	B	E	Total	%	E	other	total	%
1	18	5	23	21.7	16	5	21	23.8	22	0	22	0
2	25	0	25	0	8	15	23	65.2	24	0	24	0
3	5	17	22	77.3	26	0	26	0	31	0	31	0
4	4	18	22	81.8	21	0	21	0	22	0	22	0
Total			92				91				99	

DISCUSSION AND CONCLUSIONS

The high frequency of the appearance of variant B from N indicates that this variation is not a fortuitous incident but is a change to which the organism is predisposed. This is also true for the shift from B to E. However, the E type appears to be stable and once the organism has changed to this type it remains constant at least under the environmental conditions provided in these experiments.

Although the types described here have resulted from true mutations, there is no way to decide whether the two steps of the chain mutation N to B and B to E are changes in the same part of the genetic system or a sequence in which the change of the first induces the change of the second in a different part of the genetic system. As cytogenetic studies were not undertaken, the factors and their locations in chromosomes which might govern the cultural characteristics dealt with in this paper have not been determined.

Dimock (3) explained that the cause of the mutation that he observed in the heterothallic, saprophytic form of *H. ipomoeae* (*H. solani*) was in the nature of inactivation or alteration, rather than deletion or gene mutation since he reports that reversion from mutants to the normal type was high. If his interpretation is correct then the nature of the mutation occurring in the homothallic form is one of deletion or gene mutation rather than the inactivation or alteration of genes, because reversion has never been observed in this homothallic form of *Hypomyces*.

A comparison of the first mutation series, N to B to E, with the second series B to B1 to E1 reveals differences only in respect to quantity production of spores and perithecia. However, the first series came from N while the second series came from B or the first series. Since reversion was observed neither in the first nor second series the explanation of the nature of mutation in the first series could be applied also to the second series. Although mutation in the second series involves sporulation rather than the cultural characteristics, yet the chain mutation observed in these studies remains constant and the direction of the reaction is not disturbed.

The characteristics of the variants studied in this paper survived through the sexual stage. This fact in addition to successful hybridization is further proof that true mutations took place. Any types that were obtained from

monoconidial isolations were also obtainable from monoascosporic isolations from the same culture. But because asexual multiplication precedes sexual reproduction, there is a strong indication that the mutations studied here take place at any time in any part of the gametophyte. This view is contrary to Dimock's belief (3) that in the heterothallic form of *H. solani*, gene mutation is favored in the maturation division particularly in heterozygotes. One disadvantage of using a homothallic organism in studying variation is that it is not easy to test the unit character of the individual variants by back crossing. However, in the present studies the E type was definitely obtainable after back crossing with N, so this objection is eliminated.

The fact that all mutants except B have a greater capacity to produce spores and perithecia than the N type suggests the possibility that some variant strains might be able to compete successfully with normal strains if they were given a chance to become established in nature. However, these mutants were derived only from B which had low sporulation ability and which therefore might not be able successfully to compete with the normal type under field conditions.

SUMMARY

An analysis is made of the variability of a homothallic form of *H. solani* by use of the single spore culture method.

Two principal variants appeared, the B or Button and E or End types. Variations within these types were also observed, such as B1 and E1, but the E types remained constant.

The variants obtained by monoconidium and monoascospore cultures were predictable and occurred with high frequency, always in the sequence N to B to E, or B to B1 to E1. No reversions in type occurred.

The evidence indicates that the variations obtained were due to gene mutations or deletions, since all variants were passed unchanged through the sexual stage, and since a successful cross between N and E has been effected.

Tests were conducted to determine the effect of light on perithecium production and aging upon the incidence of variation.

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LITERATURE CITED

1. **Dimock, A. W.** Variation in a species of Fusarium induced by high concentrations of zinc salts. Cent. fur Bakt. II. Abt. **95**: 341–347. 1936.
2. ———. Hybridization studies on a zinc-induced variant of *Hypomyces ipomoeae*. Mycologia **29**: 273–285. 1937.
3. ———. Hybridization experiments with natural variants of *Hypomyces ipomoeae*. Bull. Torrey Bot. Club **64**: 499–507. 1937.
4. ———. Studies on ascospore variants of *Hypomyces ipomoeae*. Mycologia **31**: 709–727. 1939.

5. **Hansen, H. N., & R. E. Smith.** The mechanism of variation in imperfect fungi: *Botrytis cinerea*. Phytopath. **22**: 953–964. 1932.
6. **Hansen, H. N., & W. C. Snyder.** The dual phenomenon and sex in *Hypomyces solani* f. *cucurbitae*. Amer. Jour. Bot. **30**: 419–22. 1943.
7. **Hwang, Shuh-Wei, H. N. Hansen, & William C. Snyder.** Increased perithecium formation and hybridization in flooded cultures of a homothallic ascomycete. Mycologia **39**: 196–199. 1947.
8. **Snyder, William C., & H. N. Hansen.** The species concept in Fusarium with reference to section Martiella. Amer. Jour. Bot. **29**: 738–742. 1941.
9. ———. The effect of light on taxonomic characters in Fusarium. Mycologia **33**: 580–591. 1941.

3(3):327–329 FARLOWIA JULY, 1948

PROPOSED DATES FOR T. F. ALLEN'S EXSICCATAE (CHARACEAE)

R. D. WOOD [1]

Two sets of exsiccatae of Characeae were issued by Timothy Field Allen between the years of 1880 and 1898: the *Characeae Americanae Exsiccatae* and the *Characeae Japonicae Exsiccatae*. The material in these sets includes certain specimens which are accompanied by labels bearing the only published descriptions of certain *nomina nova*. In order to determine the dates of publication for these new names, it is necessary that specific dates for the exsiccatae be determined or established.

The author made a search of the literature, and with but the few exceptions listed below, found no references to the issuance of the exsiccatae. An effort was made to obtain some facts from the files of various herbaria, particularly the New York Botanical Garden where Allen studied. Further search for information in the existing private files of botanists contemporary with Allen, including those of W. A. Setchell (University of California, Berkeley) and W. G. Farlow (Farlow Herbarium, Harvard University), disclosed no additional information. It is apparently necessary arbitrarily to select the dates best substantiated by the available information, and propose that they be accepted in the future as dates of publication of the exsiccatae and the *nomina nova* concerned.

The dates for fascicles I and II of the *Characeae Americanae Exsiccatae* have become established in the literature as 1880, and were cited as such by Robinson (1906) and Tilden (1895). The remaining three fascicles have remained undated as far as is known to the writer. As the last specimens of fascicle IV do not bear collection or determination dates, the author proposes that Allen's published announcement that these fascicles had been issued (Allen, 1888, p. 6) be accepted as sufficient evidence for establishment of 1888 for fascicles III and IV. The reasonableness of this date is further substantiated by the range of collection dates which appear on some of the labels in both fascicles. Most of the specimens in fascicle V are also undated, and it is proposed that the date of publication of the description of *Chara gymnopitys* var. *keukensis* Allen (1893, p. 120) for the last specimen (No. 46) in the set be accepted as sufficient evidence for establishing 1893 for this fascicle. Thus, in citation, it is proposed that the exsiccatae set be cited as *Characeae Americanae Exsiccatae* (1880–1893).

The *Characeae Japonicae Exsiccatae* were issued in two parts, for the most part without collection or determination dates. The first portion

[1] The writer is especially indebted to Dr. R. M. Whelden and Miss Hilda Harris of the Farlow Herbarium, Harvard University; to Dr. G. F. Papenfuss of the Department of Botany, University of California, Berkeley; to Miss Rosalie Weikert of the New York Botanical Garden; and to many others for help during the search for more definite information on Allen's exsiccatae.

included specimens 1–17. It is proposed that this portion be known as *fascicle I.* The second portion of the exsiccatae was issued without dates or numbers, and included fourteen specimens. Whether this portion was issued by Allen himself, or distributed later as duplicates from his collections, is apparently not known; however, as the specimens have been distributed under the name of this set, the writer proposes that it be considered as *fascicle II.* Thus, the *Characeae Japonicae Exsiccatae* is construed to consist of two parts: fascicle I, to include specimens numbered 1–17; and fascicle II, to include the fourteen unnumbered specimens (as listed below). It is further proposed that Allen's announcement (Allen, 1895, p. 71) that the set (fasc. I) had been isued, be accepted as sufficient evidence for establishing the date of 1895. It is also proposed that the date of publication of the most recent description of the new species contained in fascicle II (Allen, 1898, p. 74) be accepted as sufficient evidence to establish 1898 as the date of issuance of fascicle II. Thus, in citation, it is proposed that the exsiccatae be cited as *Characeae Japonicae Exsiccatae* (1895–1898).

In summary, Allen's exsiccatae and the proposed dates and terms are listed below:

Characeae Americanae Exsiccatae (1880–1893).
Fasc. I. Nos. 1–10. 1880. Established.
Fasc. II. Nos. 11–20. 1880. Established.
Fasc. III. Nos. 21–30. 1888. *Proposed.*
Fasc. IV. Nos. 31–40a. 1888. *Proposed.*
Fasc. V. Nos. 41–46. 1893. *Proposed.*
Characeae Japonicae Exsiccatae (1895–1898).
Fasc. I. (*Proposed*). Nos. 1–17. 1895. *Proposed.*
Fasc. II. (*Proposed*). 14 unnumbered specimens. 1898. *Proposed.*

As the lists of exsiccatae specimens published by Allen were not completed, the additions are appended below:

Characeae Americanae Exsiccatae Fasc. V (1893).

To be added to the list published by Allen (1888, p. 6), which included fascicles I—IV. Together they form the complete list for this exsiccata set.

41. *Nitella flexilis* Ag. f. *subnidifica.*
42. *N. Bastini* Allen.
43. *N. Blankinshipii* Allen.
44. *N. formosa* Allen.
45. *N.*[2] *Hydropitys* A. Br. var. *mexicana* Allen.
46. *Chara gymnopitys* A. Br. var. *keukensis* Allen.

Characeae Japonicae Exsiccatae Fasc. II (1898).

To be added to the list published by Allen (1895, p. 71), which included fascicle I. As the following fourteen specimens were unnumbered, the writer has assigned provisional numbers to each for convenience in citing. These follow No. 17, the last specimen of fascicle I.

[2] *Nitella* should read *Chara.* In most of the sets seen by the author, *Chara* has been written over *Nitella* in ink, perhaps by Allen.

(18). *N. capitulifera* Allen.
(19). *N. capitulifera* Allen.
(20). *N. expansa* Allen.
(21). *N. gracillima* Allen.
(22). *N. laxa* Allen.
(23). *N. laxa* Allen.
(24). *N. multipartita* Allen.
(25). *N. multipartita* var. *suberecta* Allen.
(26). *N. multipartita* var. *transiliformis* Allen.
(27). *N. multipartita* var. *intermedia* Allen.
(28). *N. pseudoflabellata* A. Br. var. *imperialis* [3] Allen.
(29). *N. rigida* Allen.
(30). *N. Saito-iana* [4] Allen.
(31). *N. Tanakiana* Allen.

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LITERATURE CITED

Allen, T. F. 1888. *The Characeae of America*, Part I. New York.
———. 1893. Notes on new Characeae. *Bull. Torrey Bot. Club* **20:** 119–120.
———. 1895. Japanese Characeae II. *Bull. Torrey Bot. Club* **22:** 68–71.
———. 1898. Contributions to Japanese Characeae III. *Bull. Torrey Bot. Club* **25:** 73–82.
Robinson, C. B. 1906. The Chareae of North America. *Bull. N. Y. Bot. Gard.* **4:** 244–308.
Tilden, Josephine E. 1895. XXIII. A contribution to the bibliography of American Algae. *Minn. Bot. Studies* **1:** 295–421.

[3] "Var. *imperialis*" was apparently written on all labels which accompanied specimens of this variety, by Allen.

[4] This name appeared as "*Saitoiana*", without the hyphen, in the original description (Allen, 1898, p. 73).

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A REVIEW OF THE GENUS NITELLA (CHARACEAE) OF NORTH AMERICA [1, 2]

R. D. WOOD

INTRODUCTION

OBJECTIVE

In the past four decades, the taxonomy of the Characeae in North America has been noticeably neglected. Although many physiological studies have employed *Nitella* for experimental material, little attempt has been made to state the species under observation. Similarly, relatively few algological studies or cryptogamic floras have included members of this family. The writer is of the opinion that much of this neglect is due to the unavailability of integrative information. Though there is little doubt that the primary need is a monograph on the group, the mass of material to be studied is so vast that taxonomists dealing in this field will be engaged for some time before such a work can be completed. Robinson (1906) assembled the information on the genus *Chara* in his "The Chareae of North America." On the other hand, no single work covers the genus *Nitella* for North America.

The present paper represents a compilation of the published information on the genus *Nitella*. It is recognized that this represents but one necessary phase in the over-all objective, and as such is offered with reluctance by the writer. However, it was felt by his associates that, in light of the absence of any comparable source of information, the presentation of this paper was both timely and needed. It has been the writer's aim to assemble data on the local flora, review the literature to date, and bring the nomenclature in accord with the existing rules. It is emphasized that the writer has endeavored to report only published data, and to eliminate as far as possible his own opinions on the taxonomy of the Characeae.

BACKGROUND

Linnaeus (1753) originally delimited the genus *Chara* with four species. Agardh (1824) established the genus *Nitella* with twelve species, including the transfer of one of the Linnaean Charas (*Chara flexilis* L. = *Nitella flexilis* (L.) Ag.) to the new genus. Braun (1849: 195, 292) redefined *Nitella*, after contesting its validity for many years, emphasizing as a distinctive feature the coronular structure rather than the presence or absence of cortication. Leonhardi (1863: 72) established a third genus, *Tolypella*,

[1] Adapted from original Doctoral dissertation, "A Floristic Contribution on Nitella (Characeae) in the United States" (Northwestern University).

[2] North America for the present paper is delimited to include the continent north of Panama, exclusive of the West Indies and Greenland.

to be coordinate with *Nitella*. This same author had originally considered the status of *Tolypella* to be subgeneric.

The family Characeae (Richard *in* Humboldt and Bonpland, 1815: 38), sometimes ranked as a class or phylum, is considered in this paper to consist of two subfamilies or tribes: Chareae (Leonhardi, 1863: 72) with the genera *Chara*, *Lychnothamnus*,[3] *Lamprothamnium*,[3] and *Nitellopsis*;[3] and Nitelleae (Ganterer, 1847: 8, *pro parte*, *em.* Leonhardi, 1863: 69) with the genera *Nitella* and *Tolypella*.

The genus *Nitella*, as delimited in recent works and for the present paper, includes the Charophyte plants in which the coronula of the oogonium is composed of ten cells in two tiers, branchlets usually are furcate, ripe oospores are laterally compressed, and antheridia are apical in the furcations of the branchlets above the oogonia.

The Nitellae form a rather closely knit homogeneous group within the Characeae. The plant generally originates as a lateral sprout from a prothallus formed from germination of the oospore. Hyaline rhizoids penetrate the substrate, and the green plant grows upward into the water medium of its habitat. The primary axis consists of alternating nodal and internodal cells, with a whorl of branchlets (laterals of limited growth) being formed by lateral apical cells at each node. The branchlets divide successively one to four (or five) times into two to four (or five) rays at the branchlet nodes, the ultimate rays forming dactyls. Sex organs are usually borne at the branchlet nodes. The antheridium replaces the apical cell at a branchlet furcation. The oogonium replaces a ray, and occurs laterally at the node. The taxonomy of this group has been based largely upon the variations of these factors.[4] About one hundred and fifty species of *Nitella* have been treated in the literature for the world, with a great number of subspecific entities. Of this number, many have been reduced to synonyms.

LITERATURE

The literature bearing directly upon the species of *Nitella* in North America stems in part from European works, generally as minor considerations of larger studies. Braun (1883) reported the following species for North America:

1. *N. acuminata*
   subsp. *glomerulifera*
   var. *Lindheimeri*
   var. *subglomerata*
   var. *subglomerata* f. *brachyteles*
2. *N. Asagrayana* (Mexico)
3. *N. axillaris*
4. *N. capillata*
5. *N. capitellata*
6. *N. clavata*
   var. *inflata* (Mexico)
7. *N. flexilis*
8. *N. gracilis*
9. *N. hyalina* var. *Engelmanni*
10. *N. intermedia*
11. *N. microcarpa*
    var. *Drummondii*
    subsp. *megacarpa*

[3] These genera have not been recorded for North America.

[4] Allen, T. F., and certain other workers have also employed variations in oospore membrane patterns and size to differentiate new species.

12. *N. mucronata*
    var. *leiopyrena*
    var. *pachygyra*
    subsp. *virgata*
      f. *robustior longifurca*
      f. *tenuior*
13. *N. oligospira* var. *Wrightii*
14. *N. opaca*
15. *N. praelonga*
16. *N. pygmaea* (Mexico)
17. *N. tenuissima*
    var. *compacta*

The works of Nordstedt (1889), Groves, H. and J. (1911), and Zaneveld (1940) have contributed to the knowledge of the genus in North America mainly in critical reviews of new forms.

Halsted (1879) was the first American author to attempt a monographic treatment of the Characeae of the New World, and six species of *Nitella* were treated, including a new variety (*N. gelatinosa* var. *gigantea* Halsted = *N. praelonga* Braun). Woods (1894) assembled the information on the Characeae of Nebraska, and treated five Nitellas. Most of our knowledge of the American species of *Nitella*, as well as Characeae in general, is the result of the indefatigable labor of Allen. During the period of his active publishing on Characeae (1871–1901), he described thirty-four new species of *Nitella*, of which fourteen were described for the United States and twenty for North America. The new forms described by Allen for North America are as follows:

1. *N. annularis* (Mexico)
2. *N. Bastini* (Chicago, Illinois)
3. *N. Blankinshipii* (Missouri)
4. *N. californica* (California)
   f. *nidifica* (California)
5. *N. dilitata* (New Brunswick)
6. *N. formosa* (Mexico)
7. *N. Leibergi* (Oregon)
8. *N. Macounii* (Lake St. Clair, U.S.A. (?))
9. *N. megacarpa* (Connecticut)
10. *N. mexicana* (Mexico)
11. *N. minuta* (New Jersey)
12. *N. missouriensis* (Missouri)
13. *N. montana* (Montana)
14. *N. Morongii* (Nantucket)
15. *N. obtusa* (Canada)
16. *N. occidentalis* (California)
17. *N. stellaris* (Western U.S.A.)
18. *N. subspicata* (Missouri)
19. *N. temiscouatae* (Montana) (*nomen nudum*)
20. *N. transilis* (Massachusetts)

A number of other entities were treated in an ambiguous manner or assigned names without accompanying descriptions. Unfortunately, Allen's chief contribution on the Nitellae, *The Characeae of America*, Part II (1892, 1894, 1896), was completed only to include the monarthrodactylae group of the Nitellae, and so left a significant portion of the species untreated. A large number of floristic works have contributed distributional data on various species for the region; but, since the time of Allen, no attempt has been made to compile the information known on the species of *Nitella*.

NOTES

The plan adopted for the present paper is the usual pattern employed for floristic works. Each legitimate species, subspecies, variety, or form which has been reported for the region is described in detail or disposed of as a synonym in accordance with reports of later studies. Distribution records, exclusive of exsiccatae, are listed by countries and states. The type

localities indicated are based purely on the specimens cited in the original descriptions, and precise indications of types must await monographic treatment. The synonymies list only the critical references which bear directly upon the name employed, and the reader is referred to Groves and Bullock-Webster (1920; 1924),[5] Migula (1897),[6] and Zaneveld (1940)[7] for more complete synonymy. The literature which records species for North America is listed for each form. A review of the facts bearing upon the nomenclature is given in detail. Exsiccatae listed include only the specimens collected in the region. Where no exsiccatae have been issued for a given form, the writer has attempted to cite specimens and indicate certain herbaria in which they are deposited. Names of herbaria are abbreviated in accordance with Lanjouw (1939).[8] The bibliography includes the literature cited and the references which treat Characeae for North America. The reader is referred again to Groves and Bullock-Webster, Migula, and Zaneveld for more exhaustive lists.

Certain of the works of T. F. Allen cause difficulty in abbreviation of titles. The writer has indicated these various works as follows:

Characeae Americanae, Parts 1 and 2. 1879 — Char. Amer. **1**, **2**. 1879.
The Characeae of America, Parts 1 and 2. 1880 — Char. Amer. **1,2.** 1880.
The Characeae of America,
Part 1. 1888 — Char. Amer. **1.** 1888.
Part 2, Fasc. 1. 1892 — Char. Amer. **2**(1). 1892.
Fasc. 2. 1894 — Char. Amer. **2**(2). 1894.
Fasc. 3. 1896 — Char. Amer. **2**(3). 1896.
Characeae Americanae Exsiccatae, Fasc. I–V. 1880–1893 — Char. Amer. Exsicc. 1880–1893.

The three fascicles of Allen's (1892, '94, '96) "The Characeae of America" include a series of plates which were issued loose and without numbers. For this reason, various libraries have assembled and numbered the plates in different manners. Therefore, the writer has arbitrarily adopted the plan of assigning numbers to each plate corresponding to the sequence of names that appear in the tables of contents for the three fascicles. In case more than one plate appears for a given species, the number is assigned to the lithograph, and letters — a, b, c, d — are assigned to the photogravures in order as they are mentioned in the explanation of the plates in the text. This order very closely approximates the numbering which appears in the volume in the library of Oberlin College (589.58) except for 25, 26, and 27 which are numbered 24, 25, and 26, respectively, because both *N. minuta* and *N. pygmaea* appear on one page. The plate numbers proposed are as follows:

Fasc. 1: — 1, 1a. *opaca* — 2, 2a. *obtusa* — 3. *montana* — 4. *Blankinshipii* — 5, 5a. *missouriensis* — 6, 6a, 6b. *flexilis* — 7, 7a. *subglome-*

[5] British Charophyta, **1** (1920), **2** (1924). London.
[6] *In* Rabenhorst, Krypt.-Fl. Deutschl. Oesterr. und der Schweiz. ed. 2: **5.** 1897.
[7] Blumea **4**. 1940.
[8] Chron. Bot. **5**: 142–150. 1939.

rata — 8. *glomerulifera*; **Fasc. 2**: — 9. *capitata* — 10. *Bastini* — 11. *praelonga* — 12. *clavata* — 13. *dilitata* — 14. *Macounii* — 15. *axillaris* — 16. *Morongii* — 17. *annularis*; **Fasc. 3**: — 18. *Leibergi* — 19. *mucronata* — 20. *capitellata* — 21. *gracilis* — 22. *tenuissima* — 23. *transilis* — 24. *pygmaea* — 25. *minuta* — 26. *intermedia* — 27. *Asagrayana*.

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THE KEY

The following key is analytical in nature and represents the writer's attempt to organize the legitimate local forms into a workable scheme based upon data given in the descriptions. The classical synopsis categories of Nordstedt and Allen, i.e., brachydactylae and macrodactylae, have been by-passed in favor of what seem to be combinations of more satisfactory characters. The cases where dichotomies are based on weak distinctions reflect both the need of revision in the group and the high degree of polymorphism inherent in certain forms. The numbers preceding the species names indicate the sequence of species in the text as well as in the key. Although a concerted attempt has been made to employ vegetative characters, it has been necessary to use every available bit of information in attempting a separation of many species. For this reason, one will generally be obliged to have complete plant material with mature sex organs.

1a. Dactyls strictly 1 celled[9] ..... (2)
1b. Dactyls more than 1 celled ..... (22)
2a. At least some of the branchlets more than once divided (2–3 times in fertile branchlets) ..... **1. N. Macounii**
2b. Branchlets simple or once divided ..... (3)
3a. Branchlets in fertile whorls consisting of 2 different types, some divided and others not divided ..... **2. N. clavata**
3b. Branchlets in fertile whorls not of 2 different types ..... (4)
4a. Dactyls abruptly pointed, obtuse or acute — not acuminate ..... (5)
4b. Dactyls gradually tapering to an acuminate point ..... (14)
5a. Antheridia 130 μ in diameter; oospore membrane marked with squared or elongated elevations; oospores 210–215 μ long ..... (1. *N. Macounii*)
5b. Antheridia 245–775 μ in diameter: oospore membrane not marked with squared elevations; oospores 260–600 μ long ..... (6)
6a. Upper coronular cells of oogonia greatly elongated; oospore membrane perfectly smooth ..... **3. N. dilitata**
6b. Upper coronular cells not elongated; oospore membrane varying .... (7)
7a. Fertile branchlets progressively shortened, forming a long terminal "inflorescence"; dioecious ..... **4. N. obtusa**
7b. Fertile branchlets not forming a long terminal "inflorescence"; monoecious or dioecious ..... (8)
8a. Antheridia 500–775 μ in diameter; oospore membrane smooth to warty[10] (11)
8b. Antheridia 245–360 μ in diameter; oospore membrane granular or grumous ..... (9)
9a. Antheridia 245–285 μ in diameter; oospore membrane granular; oospores 275–535 μ long ..... (10)
9b. Antheridia 360 μ in diameter; oospore membrane grumous; oospores 540–560 μ long ..... **5. N. praelonga**
10a. Oospores 275 μ long; branchlets 8 in a whorl; antheridia 245 μ in diameter ..... **6. N. mexicana**
10b. Oospores 500–535 μ long; branchlets about 6 in a whorl; antheridia 285 μ in diameter ..... **7. N. californica**
11a. Plants strict in habit, frequently lime-incrusted; oospores 260–300 μ long ..... **8. N. Bastini**
11b. Plants not strict in habit, not lime-incrusted; oospores 375–600 μ long .. (12)
12a. Gametangia enveloped in mucus; striations of oospores very prominent and sharp-flanged ..... **9. N. capillaris**
12b. Gametangia not enveloped in mucus; striations of oospores low and thick-flanged ..... (13)
13a. Plants dioecious; dried specimens darkening to brown and becoming opaque; antheridia 650 775 μ in diameter ..... **10. N. opaca**[11]
13b. Plants monoecious; dried specimens generally pale and translucent; antheridia 500–675 μ in diameter ..... **11. N. flexilis**
14a. Plants strict in habit, frequently lime-incrusted; oospore membrane reticulate; dioecious ..... (8. *N. Bastini*)
14b. Plants not strict in habit, rarely lime-incrusted; monoecious or dioecious ..... (15)

[9] A 1-celled dactyl is interpreted in its strict sense. A terminal mucro is construed as a second cell, so that a dactyl with a mucro is considered a 2-celled dactyl. One with a crown of terminal mucros is considered a more-than-2-celled dactyl.

[10] cf. also *N. clavata* — antheridia about 400 μ in diameter; dactyls 3 (—5), cells swollen.

[11] cf. also *N. occidentalis*.

15a. Plants 5–10 cm. high; dioecious; antheridia 600–800 μ in diameter; oospore membrane granular or roughened ..... (17)[12]

15b. Plants 15–40 cm. high; monoecious; antheridia 200–650 μ in diameter; oospore membrane smooth to finely granular ..... (16)

16a. Upper coronular cells of oogonia greatly elongated; oospore membrane perfectly smooth ..... (3. *N. dilitata*)

16b. Upper coronular cells not elongated; oospore membrane varying ... (19)

17a. Oogonia isolated, 1 at a node; striations of oospores sharp and prominent, membrane roughened by scattered granules which are irregular in size ..... **12. N. Blankinshipii**

17b. Oogonia aggregated, 2–3 at a node; striations of oospores not sharp, membrane varying ..... (18)

18a. Oospores 440 x 390–400 μ, membrane finely and evenly granular, striations of somewhat blunt ridges; antheridia 750 μ in diameter ..... **13. N. montana**

18b. Oospores 345–400 x 320–365 μ, membrane coarsely granular or roughened with elevations and depressions, striations not blunt; antheridia about 800 μ in diameter ..... **14. N. occidentalis**

19a. Fertile whorls contracted into heads or clumps ..... (20)[13]

19b. Fertile whorls not contracted into heads, but becoming crowded above ..... **15. N. stellaris**[13]

20a. Heads loose, somewhat elongated; dactyls abbreviated and inflated centrally ..... (21)

20b. Heads compact and rounded; dactyls not abbreviated or inflated centrally ..... **16. N. acuminata**

21a. Antheridia 650 μ in diameter; fertile whorls not enveloped in mucus .... **17. N. missouriensis**

21b. Antheridia about 240 μ in diameter; fertile whorls enveloped in mucus (?) ..... **18. N. subspicata**

22a. Dactyls 1–2 celled, but the terminal cell not a mucro (1. *N. Macounii*)

22b. Dactyls (1—) 2 or more celled, terminal cell a mucro ..... (23)

23a. Branchlets in each whorl consisting of two series, one set (accessory branchlets) shorter than the other ..... **19. N. hyalina**

23b. Branchlets in each whorl consisting of a single series of similar branchlets (24)

24a. Branchlets in a whorl heteromorphous, some divided and others undivided ..... **20. N. Leibergi**

24b. Branchlets in a whorl quite similar ..... (25)

25a. Dactyls regularly 3 or more celled, not terminated by a 2–4 cuspidate crown ..... (26)

25b. Dactyls 1–3 (–4) celled, or terminated by a 2–4 cuspidate crown ..... (27)

26a. Sterile branchlets once divided, fertile branchlets 1–3 times divided ..... **21. N. capitellata**

26b. Sterile and fertile branchlets 3–4 times divided ..... **22. N. capillata**

27a. Sterile dactyls terminated by a 2–4 cuspidate crown ..... (28)

27b. Sterile dactyls terminated by a 1-celled mucro ..... (32)

28a. Fertile whorls forming compact heads or spikes ..... (29)

28b. Fertile whorls not forming compact heads or spikes ..... (31)

[12] Certain forms of *N. capillaris* with acuminate dactyls will key out at this dichotomy — plants 20–25 cm. high forming dense heads; antheridia about 600 μ in diameter; oospore striations 6, very sharp-flanged.

[13] cf. also *N. clavata* — see footnote 10 for entry 8.

29a. Oospore membrane granular; antheridia about 520 μ in diameter; branchlets and axial nodes swollen ..... **23. N. annularis**

29b. Oospore membrane grumous or reticulate; antheridia 170–270 μ in diameter; nodes not particularly swollen ..... (30)

30a. Heads terminal and axillary; oospore membrane grumous; antheridia about 170 μ in diameter ..... **24. N. Morongii**

30b. Heads strictly axillary; oospore membrane reticulate; antheridia 220–270 μ in diameter ..... **25. N. axillaris**

31a. Oogonia strictly solitary ..... **26. N. oligospira**

31b. Oogonia aggregated, 2 or more at a node ..... **27. N. microcarpa**

32a. Branchlets once divided ..... (33)

32b. Branchlets (1—) 2 or more times divided ..... (34)

33a. Fertile whorls forming compact heads ..... (cf. entry 29)

33b. Fertile whorls not forming compact heads ..... (34)

34a. Gametangia occurring at first branchlet nodes ..... (36)

34b. Gametangia not occurring at first branchlet nodes ..... (35)

35a. Branchlets exceeding the stem internodes in length ..... **28. N. transilis**

35b. Branchlets not exceeding stem internodes in length ..... **29. N. tenuissima**

36a. Dactyls strictly 2 celled ..... (37)

36b. Dactyls indiscriminately 2–3 (or more) celled ..... (39)

37a. Oospores 200–250 μ long, membrane strongly reticulate; gametangia not enveloped in mucus ..... (cf. entry 29)

37b. Oospores 230–400 μ long ..... (38)[14]

38a. Penultimate cells of dactyls tapering toward the base of the mucro, so that both cells are of nearly equal diameter at their conjunction .... (39)

38b. Penultimate cells not tapering, rounded at apex, several times broader than the base of the mucro at their conjunction ..... **30. N. mucronata**

39a. Plants minute, stems 130–250 μ in diameter ..... (40)

39b. Plants larger, stems 300 or more μ in diameter ..... (42)

40a. Branchlets 1–2 times divided; oospores 350 x 285 μ, mature membrane granular; antheridia 200 μ in diameter ..... **31. N. minuta**

40b. Branchlets 2–3 times divided; mature oospore membrane reticulate (41)

41a. Oospore striations prominent and flanged; antheridia 175–200 μ in diameter ..... **32. N. Nordstedtiana**

41b. Oospore striations faint, not flanged; antheridia 240–250 μ in diameter ..... **33. N. pygmaea**

42a. Fertile whorls contracted into pedunculate heads, enveloped in mucus; oospore membrane grumous, antheridia about 170 μ in diameter[15] ..... **34. N. Asagrayana**

42b. Fertile whorls diffuse or in heads (heads not pedunculate), with or without mucus; oospore membrane not grumous; antheridia 240–400 μ in diameter ..... (43)

43a. Oospore membrane reticulate ..... (44)

43b. Oospore membrane not reticulate ..... (45)

44a. Upper axial internodes 1–2 times the length of the branchlets; oogonia solitary (rarely geminate) ..... (30. *N. mucronata*)

44b. Upper axial internodes ½–1 times the length of the branchlets; oogonia aggregated, 2–4 (— more) at a node ..... (27. *N. microcarpa*)

45a. Dactyls 2–3, 2 (rarely 3) -celled; oospore 360 μ long; antheridia 240 μ in diameter; fertile whorls enveloped in mucus ..... **35. N. intermedia**

[14] cf. also *N. oligospira*.

[15] cf. also *N. Morongii*.

45b. Dactyls 3–4, 2–3-celled; oospores 250–300 μ long; antheridia 300 μ in diameter; fertile whorls not enveloped in mucus ..... **36. N. gracilis**

1. Nitella Macounii Allen

Tolypella Macounii Allen, Bull. Torrey Bot. Club **14**: 212 (descr.), pl. 72–73. 1887. — ibid., **15**: 11 (= *Nitella Macounii* Allen). 1888.

Nitella Macounii Allen, Bull. Torrey Bot. Club **15**: 11 (descr.). 1888.

LITERATURE FOR NORTH AMERICA:

Tolypella Macounii: Allen (1887: 212). — ibid. (1888: 11) (= *N. Macounii* Allen).

Nitella Macounii: Allen (1887: 212). — Char. Amer. **1**: 39, 43 (key). 1888. — Nordstedt, Lunds Univ. Årsskr. **25**(4): 7. 1889. — Allen, Char. Amer. **2**(1): 2 (key). 1892. — ibid., **2**(2): 9 (key), 14 (descr.), pl. 14. 1894.

Plant monoecious, 5–10 cm. high, densely tufted and much branched. **Sterile branchlets** about 8 in a whorl, heterophyllous in that a few are undivided, forming elongate 2-celled branchlets; some 2–3 times divided, terminating in about 4, 2-celled dactyls. **Dactyls of sterile branchlets** 2-celled, with abrupt point (not mucronate). **Fertile branchlets** once or twice divided, frequently terminating in 4 dactyls. **Dactyls of fertile branchlets** frequently 4, 2-celled (not mucronate), abruptly pointed. **Gametangia** occurring at ultimate branchlet furcation. **Oogonia** aggregated, 2–3 together. **Oospores** 210–215 μ long, 200–210 μ broad; **striations** of 7–8 ridges; **membrane** marked by short elevations at right angles from the ridges and irregularly distributed in the fossae. **Antheridia** terminal in ultimate branchlet furcations (further data not given).[16]

ILLUSTRATIONS: Allen (1887: pl. 72–73; 1894: pl. 14).

EXSICCATAE: None. Specimen: *J. Macoun 8*, July 6, 1883. Above the Fall, Canada Side, shore of the Niagara River, Canada (NY).

DISTRIBUTION FOR NORTH AMERICA: **Canada:** — shore of Niagara River, Allen (1887: 212; 1888: 11; 1894: 15) (TYPE LOCALITY); **United States** (?): — Lake St. Clair, Allen (1894: 15).

Allen first described this plant as a *Tolypella*, based on the specimen cited as "collected by Prof. John Macoun near Niagara Falls, and subsequently in Lake St. Clair." He later discovered the terminal position of the antheridia, and redescribed the plant as a *Nitella*.

2. Nitella clavata Kützing

Nitella clavata Kützing, Spec. Alg. p. 518. 1849. — Bertero ex Braun, Hooker's Journ. Bot. **1**: 195. 1849. (nom. nud.).

Chara clavata Gay, Hist. Fis. y Pol. Chile **6**: 551. 1854.

LITERATURE FOR NORTH AMERICA:

Nitella clavata: Braun, Abh. k. Akad. Wiss. Berlin (1882): 43. 1883. — Allen, Char. Amer. **1**: 42 (fig. 46), 43 (key), 46. 1888. — Nordstedt, Lunds Univ. Årsskr. **25**(4): 7. 1889. — Allen, Char. Amer. **2**(1): 2 (key), 5. 1892. — *in* Williams, Bull. Torrey Bot. Club **19**: 194. 1892. — Char. Amer. **2**(2): 9 (key), 12, 13, pl. 12. 1894. — Bull. Torrey Bot. Club **23**: 7. 1896. — Daily, Butler Univ. Bot. St. **6**: 151. 1944.

[16] Allen (1894: 14).

Nitella translucens: Halsted (pro parte, cf. *N. praelonga*), Proc. Boston Soc. Nat. Hist. **20**: 175. 1879.[17]

Plant monoecious, very translucent, 40–50 cm. high. **Stem** stout, the branchlets nearly equal the stem internodes in diameter. **Branchlets** of two kinds in a whorl, an inner shorter whorl and an outer longer whorl bearing dactyls. **Sterile branchlets** 6–8 in a whorl, undivided. **Fertile branchlets** 3–6 (–8) in a whorl, once divided into 3 (rarely 5) dactyls. **Dactyls** 3 (rarely 5), short, swollen cells, terminating in an abrupt or acuminate point. **Gametangia** borne at the node of the fertile branchlets; not enveloped in mucus (?). **Oogonia** usually 3, lateral at the fertile branchlet nodes. **Oospores** 300–470 μ long, 300–420 μ wide; **striations** showing 6–7 prominent and sharp ridges; **membrane** minutely granular. **Antheridia** 300–400 μ in diameter.[18]

ILLUSTRATIONS: Allen (1894: pl. 12), Braun (1883: pl. 1, fig. 33, 34).

EXSICCATAE: Phyc. Boreali-Amer., Fasc. XXVIII, *1381*. Issued as duplicates from the herbarium of T. F. Allen apparently posthumously by the New York Botanical Garden: *M. A. Howe*, Oct. 1892. Lake Merced, San Francisco, Calif.; *H. N. Bolander*, Oct. 22, 1865. In water works, San Francisco, Calif.; *C. G. Pringle*, Oct. 5, 1888. Arroyo Ancho, Sierra Madre, Western Chihuahua, Mexico.

DISTRIBUTION FOR NORTH AMERICA: **Mexico:** — Orizaba, Braun (1883: 43), Nordstedt (1889: 7); — San Luis Potosi, Allen (1894: 13); **United States**: — California, Braun (1883: 43), Allen (1894: 13); — Missouri, Allen (1894: 13); — Montana, Allen *in* Williams (1892: 194), Allen (1894: 13); — Nebraska, Daily (1944: 151); — New Mexico, Allen (1894: 13), Braun (1883: 43); — North Carolina, Braun (1883: 53); — Oregon, Allen (1894: 13).

Allen (1894: 12) stated that this species was essentially a Pacific Coast species.

TYPE LOCALITY: Vittoria, Brazil.

The credit for this species is usually given to Bertero and Braun in the citation *N. clavata* (Bertero) Braun. This practice is apparently based upon the first mention in the literature, which was by Braun (1849: 195), in which Bertero's name appeared as the author, and meant to give credit to Bertero who collected the specimen (Coll. No. *167*, as *Chara clavata* Bertero, ined.). However, as this was published without description, it must be considered a *nomen nudum* without valid status. The first published description was by Kützing (1849: 518) based on the specimen cited as "In Brasilia legit *Sellow* (v. in herb. Berolinensi)." Groves, H. and J. (1911: 33) are the only writers who have recognized Kützing as the author of this species.

Nitella clavata var. **inflata** Braun

Nitella Pottsii Seemann, in litt. 1855.

[17] Halsted lists the specimens — [*Bolander*], San Francisco water works; and *C. Wright 1*, from West Texas; both of which concur with those listed under *N. clavata* by Braun (1883: 43).

[18] Allen (1894: 12).

Nitella clavata var. *Mülleri* Schaffner, in sced. 1856;[19] Fl. Mex. Exsicc. (ined.), No. *314*.
Nitella clavata var. *inflata* Braun, Abh. k. Akad. Wiss. Berlin (1882): 43. 1883.

LITERATURE FOR NORTH AMERICA:
Nitella clavata var. *Mülleri*: Braun (1883: 43, 143).
Nitella clavata var. *inflata*: Allen, Char. Amer. **2**(2): 12, 13. 1894.

This variety differs from the species by the enormously inflated branchlets, such that the fertile branchlets resemble small balls 5 mm. in diameter. Oogonia are often stipitate; and the oospores may have 8 angles.[20]

ILLUSTRATIONS: Braun (1883: pl. 1, fig. 34).

EXSICCATAE: None [?].

DISTRIBUTION FOR NORTH AMERICA: **Mexico:** — Tacubaya near Mexico City, and Chapultepec, Braun (1883: 43) (TYPE LOCALITIES); **United States:** — California, Allen (1894: 13) for the Santa Catalina Islands.

This variety was described by Braun (1883: 43) based on the specimen cited as "In einer einzigen Lagune bei Tacubaya in der Nähe der Stadt Mexico (gef. Aug. 1854 von Wilhelm Schaffner. Mexico, L. Hahn 1868). Sehr selten in Wassergräben zwischen den Lagunen bei Chapultepec, Mai 1854 (c. Potts)."

Apparently Allen's (1894: 12) verbatim repetition of Braun's words is the only further study which has appeared in the literature concerning this variety.

3. Nitella dilitata Allen

Nitella dilitata Allen, Char. Amer. **2**(2): 13. 1894.

LITERATURE FOR NORTH AMERICA:
Nitella dilitata: Allen, l.c., p. 9 (key), 13 (descr.), pl. 13.

Plant monoecious (?). **Branchlets** 6 in a whorl. **Sterile branchlets** simple or once divided. **Fertile branchlets** once divided, and contracted into dense heads. **Dactyls of fertile branchlets** (2–) 3 (–5), 1-celled, somewhat inflated below, tapering to an acute point. **Gametangia** occurring together at the division of the branchlets, mucus (?). **Oogonia** solitary or aggregated; **coronula** deciduous, the upper series of cells greatly elongated, much longer than the lower series. **Oospore** 440–480 μ long, 360–375 μ broad; **striations** of 6–7 not prominent ridges; **membrane** perfectly smooth. **Antheridia** 530–580 μ in diameter.[21]

ILLUSTRATIONS: Allen (1894: pl. 13).

EXSICCATAE: No duplicates have been issued. Original specimen (NY).

DISTRIBUTION FOR NORTH AMERICA: **Canada:** — New Brunswick, Allen (1894: 13) for Canaan Forks (TYPE LOCALITY).

The literature on this species seems to be limited to the original paper by Allen (1894), in which the species was described on the specimen cited as

[19] Sced., cf. footnote to Species 34, *N. Asagrayana*.
[20] Allen (1894: 12).
[21] Allen (1894: 13).

"Prof. Macoun, of Canada, collected by Mr. John Moser, at Canaan Forks, New Brunswick." Allen (1894: 14) states that this locality may be incorrect, possibly having been confused with a locality for *N. clavata*.[22]

4. Nitella obtusa Allen

Nitella temiscouatae Allen, Bull. Torrey Bot. Club **19**: 230. 1892. (nom. nud.).
Nitella obtusa Allen, Char. Amer. **2**(1): 1 (footnote, key), 3 (descr.), pl. 2, 2a. 1892.

LITERATURE FOR NORTH AMERICA:
Nitella temiscouatae: Northrop and Northrop, Bull. Torrey Bot. Club **17**: 30. 1890. (sine nom.).[23]
Nitella obtusa: Allen, Char. Amer. **2**(1): 1 (footnote, key), 3 (descr.), pl. 2, 2a. 1892.

Plant dioecious, 20–25 cm. high, densely tufted. **Sterile branchlets** (7–) 8, 3–5 cm. long, exceeding the axial internodes in length, once divided into 1–3 dactyls. **Fertile branchlets** 1–3, 1-celled, becoming progressively shortened upward forming a long terminal stem, once divided into 1–2 dactyls. **Dactyls of fertile branchlets** usually 2, 1-celled, one generally much reduced. **Gametangia** borne on separate plants. **Oogonia** solitary or aggregated, enveloping cells with blunt, usually inflated tips; **coronula** evanescent. **Oospores** about 460 μ long, 400 μ broad; **striations** of 7 thick and prominent ridges; **membrane** granular. **Antheridia** (no data given).[24]

ILLUSTRATIONS: Allen (1892: pl. 2).

EXSICCATAE: Issued as duplicates from the herbarium of T. F. Allen apparently posthumously by the New York Botanical Garden: *T. Morong* 7, Aug. 25 & 27, 1891. Lake Temiscouata, Province of Quebec, Canada.

DISTRIBUTION FOR NORTH AMERICA: **Canada:** — Quebec, Lake Temiscouata (TYPE LOCALITY), Allen (1892: 3).

The literature is restricted to the works of the original author, the description being based on the specimen cited as "gathered by the late Dr. Northrup [25] and his wife in Lake Temiscouata, Canada."

5. Nitella praelonga Braun

Nitella flexilis subsp. *N. praelonga* Braun, Monatsber. k. Akad. Wiss. Berlin (1867): 796. 1868. (nom. nud.).
Nitella praelonga Braun, Abh. k. Akad. Wiss. Berlin (1882): 40 (descr.). 1883.

LITERATURE FOR NORTH AMERICA:
Nitella praelonga: Ravenel, Bull. Torrey Bot. Club **6**: 82. 1876. (nom. nud.). — Allen, Char. Amer. **2**: 10. 1880. (nom. nud.). — Braun, Abh. k. Akad. Wiss. Berlin (1882): 40. 1883. — Allen, Char. Amer. **1**: 8, 43 (key). 1888. — ibid.,

[22] The writer awaits any specimens or confirmed records of *N. clavata* for New Brunswick, which might substantiate Allen's conjecture.
[23] Reported collecting two Charas en route between Notre Dame du Lac and Mount Wissick, in a portion of Lake Temiscouata. One (?) of these is presumably the type specimen of *N. obtusa*.
[24] Allen (1892: 3).
[25] Misspelled for Northrop.

2(1): 2 (key). 1892. — ibid., **2**(2): 11, 12, pl. 11. 1894. — Lillick, Papers Michigan Acad. **22** (1936): 149. 1937.

Nitella gelatinosa var. *gigantea*: *Halsted*, Proc. Boston Soc. Nat. Hist. **20**: 174. 1879. (= *N. praelonga* Braun, according to Braun (1883: 40) and Allen (1894: 11)).

Nitella translucens: Halsted (pro parte, cf. *N. clavata*), l.c., p. 175.[26]

Plant monoecious, robust. **Stem** up to 2.5–3 mm. in diameter, and 1.5–2 meters high. **Branchlets** 8 in a whorl. **Sterile branchlets** undivided, 1-celled, terminating in an abrupt point. **Fertile branchlets** once divided. **Dactyls of fertile branchlets** 2–3, 1-celled. **Gametangia** aggregate at the node of the fertile branchlets, enveloped in mucus. **Oogonia** 730–780 μ long by 600–650 μ wide. **Oospores** black, 540–560 μ long by 500–550 μ wide; **striations** of 6–7 sharp and prominent ridges; **membrane** grumous, having the appearance of matted felt. **Antheridia** about 360 μ in diameter, borne on elongated spikes.[27]

ILLUSTRATIONS: Allen (1894: pl. 11), Lillick (1937: pl. 17, 18).

EXSICCATAE: Issued as duplicates from the herbarium of T. F. Allen apparently posthumously by the New York Botanical Garden: *C. Mohr*, May 28, 1884. Mobile, Alabama (NY).

DISTRIBUTION FOR NORTH AMERICA: **United States:** — Illinois, Braun (1883: 42); — South Carolina, Ravenel (1876: 82), Braun (1883: 40) for the Santee Canal (TYPE LOCALITY), Allen (1894: 11); — Texas, Braun (1883: 41) which reported the specimen in Lindheimer's Flora Texana Exsiccatae[28] No. *753*, Lillick (1937).

The name *N. praelonga* first appeared in the literature in Braun's (1868: 796) "Die Characeen Afrika's" without a description. He later described the species in his "Fragmente einer Monographie der Characeen" (1883: 40) based on Ravenel's (1876: 82) specimen which Braun cited as "Nord-Amerika. In Carolina australi 'submersed in the Santee Canal' (C. Ravenel comm. Engelmann 1853 sub no. VII)."

Allen's description (1894: 11) was practically a verbatim translation of Braun's words with an error in the size of the oospore, which was translated as "500 to 560 microns" instead of the original "0,54–56 mm.," and the omission of the number of branchlets in a whorl which Braun gave as eight. Halsted's (1879: 174) description of his *N. gelatinosa* var. *gigantea* agreed rather closely with that of Braun's original for *N. praelonga*.

The species is generally conceded to be one of the largest Charophytes known, and is certainly the largest in the United States, generally reaching its maximum proportions in warm waters of the southern states.

[26] Halsted lists the specimen — *F. Lindheimer*, Aug. 1847, near Guadaloupe, Flora Texana, No. *41*. Braun determined this (No. *461*[?]) as *N. praelonga*.

[27] Braun (1883: 40), supplemented from Allen (1894: 11).

[28] The reference to Lindheimer, Flora Texana Exsiccatae, appears in Braun's (1883: 41) works, but in correspondence with the University of Texas, the writer has been informed by Dr. B. C. Tharp of that institution that "So far as I know this was a purely herbarium duplicate issue." The specimens are now deposited in the Missouri Botanical Garden, St. Louis, Mo

6. Nitella mexicana Allen

Nitella mexicana Allen, Bull. Torrey Bot. Club **21**: 165 (descr.), pl. 186. 1894.

LITERATURE FOR NORTH AMERICA:

Nitella mexicana: Allen, l.c. — ibid., **23**: 533. 1896.

Plant monoecious. **Branchlets** 8 in a whorl, once divided. **Dactyls** 2–3, 1-celled, apiculate. **Gametangia** aggregated, not enveloped in mucus. **Oogonia** aggregated, 1–3 at a node. **Oospores** 275 μ long, 230 μ wide; **striations** of 5 prominent ridges; **membrane** very finely granular. **Antheridia** 245 μ in diameter.

ILLUSTRATIONS: Allen (1894: pl. 186).

EXSICCATAE: None issued. Specimen: *Brooks*, Oct. 4, 1890. San Luis Potosi, Canoas, Mexico (NY).

DISTRIBUTION FOR NORTH AMERICA: **Mexico:** — San Luis Potosi, Canoas, Allen (1894: 165) (TYPE LOCALITY).

Allen (1894: 165) originally described the species on the specimen cited as "collected by Mr. Pringle in slow-flowing streams in Mexico."

7. Nitella californica Allen

Nitella californica Allen, Bull. Torrey Bot. Club **21**: 166. 1894.

LITERATURE FOR NORTH AMERICA:

Nitella californica: Allen, l.c. — ibid., **23**: 533. 1896.

Plant monoecious, of medium size, similar to *N. flexilis*. **Fertile branchlets** once divided, about 6 in a whorl. **Fertile dactyls** 1-celled, abruptly pointed. **Sterile branchlets** 6 in a whorl, not or once divided. **Dactyls of sterile branchlets** elongated, often incurved. **Gametangia** aggregated, usually 2 oogonia and 1 antheridium at a node. **Oogonia** usually 2 at a node; **coronula** not persistent. **Oospores** 500–535 μ long, 450–530 μ wide; **striations** 6–7, prominent; **membrane** granular. **Antheridia** 285 μ in diameter.[29]

ILLUSTRATIONS: Allen (1894: pl. 185).

EXSICCATAE: Allen, under the label title "Characeae Americanae Exsiccatae," but apparently issued posthumously by the New York Botanical Garden: *Blankinship*, 1894. Lake Co., Calif. (NY).

DISTRIBUTION FOR NORTH AMERICA: **United States:** — California, Allen (1894: 166) for Lake County (TYPE LOCALITY).

The literature for this species is limited to the original description and one additional note defining a forma *nidifica*. The species description by Allen (1894: 166) is based on the specimen cited as ". . . collected by Mr. J. W. Blankinship, in Lake County."

Nitella californica forma **nidifica** Allen

Nitella californica forma *nidifica* Allen, Bull. Torrey Bot. Club **21:** 166. 1894.

LITERATURE FOR NORTH AMERICA:

Nitella californica forma *nidifica*: Allen, l.c. — Char. Amer. Exsicc. 1893. (cf. under Exsiccatae).

[29] Allen (1894: 166).

This form differs from the species *N. californica* Allen in having the fertile whorls condensed into rather tight heads.[30]

ILLUSTRATIONS: None.

EXSICCATAE: Phyc. Boreali-Amer., Fasc. XXIX, *1434*; Allen, under the label title "Characeae Americanae Exsiccatae," but apparently issued posthumously by the New York Botanical Garden: *J. W. Blankinship*, June 12, 1893. Humboldt Co., Calif.

DISTRIBUTION FOR NORTH AMERICA: **United States**: — California, Allen (1894: 166) for Humboldt County (TYPE LOCALITY).

The literature for this form is limited to the original description by Allen (1894: 166) based on the specimen cited as ". . . collected by the same gentleman [Mr. J. W. Blankinship] in Humboldt County, June 12, 1893."

8. Nitella Bastini Allen

Nitella Bastini Allen, Char. Amer. **2**(2): 10. 1894.

LITERATURE FOR NORTH AMERICA:

Nitella Bastini: Allen, l.c., p. 9.

Plant dioecious, 2–3 cm. high, quite rigid, occasionally incrusted with lime; two sexes somewhat different. **Branchlets** 8–12 in a whorl, once divided; in female plants, the primary rays 2675 μ long by 320 μ in diameter. **Dactyls** variously 1–3, unequal in length, all 1-celled, tapering to an abruptly acuminate point. **Gametangia** occurring on separate plants, enveloped in mucus; apparently sometimes stipitate. **Oogonia** aggregated, occurring at the base of the primary ray or at the branchlet node. **Oospore** 265–300 μ long, 235–250 μ wide; **striations** of 7–8 ridges; **membrane** irregularly but markedly reticulate. **Antheridia** 600–625 μ in diameter.[31]

ILLUSTRATIONS: Allen (1894: pl. 10).

EXSICCATAE: Allen, Char. Amer. Exsicc. *42*; Phyc. Boreali-Amer., Fasc. XXIX, *1433*; and also issued as unnumbered specimen under the title "Characeae Americanae Exsiccatae."

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Illinois, Allen (1894: 10) for site of the World's Fair, Chicago (TYPE LOCALITY, now destroyed).

The literature for this species is limited to the original description by Allen (1894: 10), based on the specimen cited as "Chicago, near that city, on the site of the World's Fair (the original locality is destroyed) [collected by Bastin]."

9. Nitella capillaris (Krocker) Groves and Bullock-Webster

Chara capillaris Krocker, Florae Silesiacae **3**: 62. 1814.

Chara capitata Nees von Esenbeck, Denkschr. k. beierisch. bot. Gesell. **2**: 80. 1818. — non Elliott (1824: 516) (=*N. capitellata* Braun).

Nitella capitata Agardh, Syst. Alg. p. 125. 1824.

Nitella capillaris Groves & Bullock-Webster, Brit. Char. **1**: 96. 1920.

LITERATURE FOR NORTH AMERICA:

?*Chara capitata*: Riddell (ined.) — ?

[30] Allen (1894: 166).

[31] Allen (1894: 10).

Nitella capitata: Braun, Monatsber. k. Akad. Wiss. Berlin (1867): 788, 783. 1868. — Allen, Bull. Torrey Bot. Club **2**(3): 9. 1871. — Braun, Abh. k. Akad. Wiss. Berlin (1882): 32. 1883. — Allen, Char. Amer. **1**: 41 (key). 1888. — Dame and Collins, Fl. of Middlesex Co., Mass. p. 151. 1888. — Allen, Char. Amer. **2**(1): 2 (key). 1892. — ibid., **2**(2): 9 (key), 10 (descr.), pl. 9. 1894. — non Halsted (1879: 173) (– *N. acuminata* subsp. *glomerulifera* Braun).

Plant dioecious, slender, up to 20–25 cm. high. **Branchlets** 6–9 in a whorl, once divided, the primary rays nearly equal in length to the secondary. **Fertile branchlets** very short, condensed into dense heads. **Dactyls** usually (2–) 3 (–4), 1-celled; apical cell variable from blunt to sharp pointed. **Gametangia** borne on separate plants, enveloped in mucus. **Oogonia** solitary or 2–3 together at the division of the branchlet, 550–575 μ long by 425–450 μ wide; **coronula** 25–35 μ high, deciduous. **Oospore** 375–400 μ long, 325–375 μ wide, and 300 μ thick; chestnut-brown; **striations** of about 6 very prominent and sharp-flanged ridges; **membrane** with minute, non-contiguous, rounded tubercles. **Antheridia** about 600 μ in diameter.[32]

ILLUSTRATIONS: Allen (1894: pl. 9), Groves & Bullock-Webster (1920: pl. 6).

EXSICCATAE: Issued as duplicates of the herbarium of T. F. Allen apparently posthumously by the New York Botanical Garden: *T. F. Allen*, 1870. Islip, Long Island, New York; *A. B. Langlois*, Louisiana.

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Massachusetts, Braun (1883: 32), Allen (1894: 10), Dame and Collins (1888: 151); — New York, Braun (1883: 32), Allen (1894: 10).

TYPE LOCALITY: Europe.

Throughout the majority of Characean literature, this plant has been designated as *Nitella capitata* (Nees von Esenbeck) Agardh, or some combination of the author citation. Groves and Bullock-Webster (1920: 97) showed the earlier described *Chara capillaris* Krocker (1814: 62) to be at least in part identical to that of Nees von Esenbeck; and, hence, published the new combination *N. capillaris* (Krocker) Groves and Bullock-Webster. If, as these writers contend, Krocker's plant is identical to that of Nees von Esenbeck, their move is justified. If, as contemporary opponents contend, Krocker's description was not based upon that portion of the several species (which Krocker labeled under this name) which is now recognized as *N. capitata*, then the generally accepted synonym must be re-established.

From the point of view of North American Nitellas, two works should be mentioned. The first is Elliott's (1824: 516) description of a *Chara capitata* Elliott, which subsequently was redescribed and has become established as *Nitella capitellata* Braun (cf. under that species). The second is Halsted's (1879: 173) report of *Nitella capitata* Ag. for Uxbridge, Mass. This plant was shown by Braun (1883: 39) to be *Nitella acuminata* subsp. *glomerulifera* Braun.

[32] Groves & Bullock-Webster (1920: 97), supplemented from Migula (1897: 112).

10. Nitella opaca (Agardh ex Bruzelius) Agardh

(Non) *Chara flexilis* Linn., Spec. Alg. p. 1157. 1753. (=*N. flexilis* (Linn.) Ag.).
Chara flexilis Smith, Eng. Bot. pl. 1070. 1802.
Chara opaca Agardh ex Bruzelius, Obs. in Gen. Char. p. 16. 1824.
Nitella opaca (Agardh ex Bruzelius) Agardh, Syst. Alg. p. 124. 1824.

LITERATURE FOR NORTH AMERICA:

Nitella opaca: Braun, Monatsber. k. Akad. Wiss. Berlin (1867): 875. 1868. — Halsted, Proc. Boston Soc. Nat. Hist. **20**: 173. 1879. — Robinson, Fl. Essex Co., Mass. p. 146. 1880. — Braun, Abh. k. Akad. Wiss. Berlin (1882): 32. 1883. — Allen, Char. Amer. **1**: 7, 40 (fig. 42), 41 (key). 1888. — Bull. Torrey Bot. Club **19**: 194, 230. 1892. — Char. Amer. **2**(1): 2, 3, pl. 1, 1a. 1892. — Collins, Fl. Mt. Desert, Me. p. 277. 1894. — Woods, Fl. Nebraska p. 124, pl. 27. 1894. — Sawyer, M. S. Thesis (ined.) p. 18. 1926. — Prescott, Univ. Iowa Studies Nat. Sci. **13:** 140. 1931. — Daily, Butler Univ. Bot. St. **6**: 152, pl. 1-c. 1944. — ibid., **7**: 126. 1945.

? *Nitella syncarpa*: Allen, Bull. Torrey Bot. Club **2**(3): 9. 1871. (cf. Allen (1892: 2; 1894: 10)).

Plant dioecious, moderately stout. Internodes usually 2–4 times the length of the branchlets. **Branchlets** 6–7 in a whorl. **Sterile branchlets** once divided, usually stout. **Dactyls of sterile branchlets** 2–3, 1-celled. **Fertile branchlets** usually shorter than sterile branchlets, forming more or less dense heads (sometimes lax), once divided. **Dactyls of fertile branchlets** 1-celled. **Gametangia** occurring together at the division of the branchlets, not enveloped in mucus. **Oogonia** solitary or geminate, about 650–700 μ long by 500–565 μ broad; **coronula** 25–40 μ high, deciduous. **Oospore** spheroidal, sometimes broader than long, about 375–425 μ long, 350–400 μ wide, and 250 μ thick, dark chestnut-brown to almost black; **striations** of 7 rather thick ridges, often broadening into flanges at apex; **membrane** red-brown or yellow-brown, smooth or scabrous with wart-like protuberances. **Antheridia** large, about 650–775 μ in diameter.[33]

ILLUSTRATIONS: Allen (1892: pl. 1), Groves & Bullock-Webster (1920: pl. 7), Woods (1894: pl. 27).

EXSICCATAE: Char. Amer. Exsicc. *33*; Phyc. Boreali-Amer., Fasc. XXIX, *1436*. Issued as duplicates from the herbarium of T. F. Allen apparently posthumously by the New York Botanical Garden: *Faxon*, July 20, 1884. Ammonoosuc Lake, White Mountains, N. H.; *Faxon*, July 20, 1885 (ibid.); *Faxon*, Sept. 1, 1884 (ibid.); *Pringle*, Aug. 21, 1896, Tlalpam, Valley of Mexico; *E. Faxon*, June 20, 1885. Westmore, Vt.; *E. Faxon*, June 19, 1884, Saco Lake, Wt. Mt., N. H.; *Faxon*, June 19, July 20, 1884. Source of Saco River, White Mountains, N. H.

DISTRIBUTION FOR NORTH AMERICA: **Mexico**: — Tabasco, Braun (1883: 32), Allen (1892: 3); **United States**: — California, Allen (1892: 3); — Indiana, Daily (1945: 126); — Iowa, Sawyer (1926: 18), Prescott (1931: 140); — Louisiana, Braun (1883: 32), Allen (1892: 3); — Maine, Collins (1894: 227); — Massachusetts, Robinson (1880: 146), Allen (1892: 3); — Montana, Allen (1892: 194, 230); — Nebraska, Woods (1894: 124), Daily (1944: 152); — Nevada, Braun (1883: 32), Allen (1892: 3); — New Hampshire, Allen (1892: 3); — New York, Allen (1892: 3); — Oregon, Allen (1892: 3); — Pennsylvania, Allen (1892: 3); — Texas, Braun (1883: 32), Allen (1892: 3); — Utah, Braun (1883: 32); **Canada**: — Allen (1892: 3).

TYPE LOCALITY: Europe.

[33] Groves & Bullock-Webster (1920: 100).

This plant was apparently first validly described by Smith (1802, pl. 1070) as *Chara flexilis* Smith. This name, however, was preoccupied by *C. flexilis* Linn. (1753) (=*N. flexilis* (Linn.) Ag.). The next later description appeared in Bruzelius (1824: 16) under the name "*C. opaca* Ag." Agardh (1824: 124) in the same year, but apparently at a later date, transferred the plant to the genus *Nitella* as *N. opaca*. In the synonymy he listed "*C. opaca* Ag. Bruz." Agardh, therefore, must have suggested the new species to Bruzelius, who published the name (Agardh ex Bruzelius), and subsequently Agardh made the transfer. The writer has for these reasons cited the name as *N. opaca* (Ag. ex Bruz.) Ag.

11. Nitella flexilis (Linn. pro parte) Agardh

Chara flexilis Linnaeus, Spec. Plant. p. 1157. 1753.

Nitella flexilis (Linnaeus, pro parte) Agardh, Syst. Alg. p. 124. 1824.

LITERATURE FOR NORTH AMERICA:

Chara flexilis: Riddell, Syn. Fl. West. States p. 110. 1835. (= ? *N. flexilis* (Linn.) Ag.).

Nitella flexilis: Kützing, Spec. Alg. p. 514. 1849. — Wallman, K. Vets.-Akad. Handl. (1852): 261. 1854. — Allen, Bull. Torrey Bot. Club **2**(3): 9. 1871. — Halsted, Proc. Boston Soc. Nat. Hist. **20**: 175. 1879. — Robinson, Fl. Essex Co., Mass. p. 146. 1880. — Braun, Abh. k. Akad. Wiss. Berlin (1882): 34. 1883. — Allen, Char. Amer. **1**: 6, 30 (fig. 39), 40 (fig. 43). 1888. — Dame and Collins, Fl. Middlesex Co., Mass. p. 151. 1888. — Owen, Pl. Nantucket p. 74. 1888. — Allen *in* Britton, Final Rep. St. Geol. (N. Jersey) **2**: 356. 1889. — Char. Amer. **2**(2): 1 (key), 2, 6, pl. 6, 6a, 6b. 1892. — Webber, Trans. Acad. Sci. St. Louis **6**: 20. 1892. — Collins *in* Rand and Redfield, Fl. Mt. Desert, Me. p. 227, 1894. — Woods, Fl. Nebraska p. 123, pl. 26. 1894. — Allen, Bull. Torrey Bot. Club **23**: 533. 1896. — Bach, Mich. Acad. Sci., Ann. Rep. **9**: 126. 1907. — Burnham & Latham, Torreya **23:** 4. 1923. — Grier, Amer. Midl. Nat. **9:** 60. 1924–5. — Daily, Butler Univ. Bot. St. **7**: 126. 1945.

Plant monoecious, moderately stout. Internodes usually 1½–2 times as long as the branchlets. **Branchlets** 6–8 in a whorl, straight or slightly incurved; once divided or sometimes with one simple node; primary rays usually about twice the length of the secondary ray. **Fertile branchlets** usually similar to sterile branchlets, sometimes shortened and forming heads. **Dactyls** 2–3 (or single), 1-celled, acute (rarely slightly apiculate). **Gametangia** occurring together at the branchlet node. **Oogonia** usually 2–3 together, varying much in size, 625–900 μ long by 550–750 μ broad; enveloping cells swelling considerably at the apex; **coronula** about 40μ high, deciduous. **Oospores** 500–575 μ long, 425–500 μ broad, 375 μ thick, dark reddish-brown to black; **striations** of 5–7 stout, prominent ridges which broaden into flanges at the apex; **membrane** smooth or scabrous with wart-like protuberances. **Antheridia** about 500–625 μ in diameter.[34]

ILLUSTRATIONS: Allen (1892: pl. 6, 6a, 6b), Groves & Bullock-Webster (1920: pl. 8), Woods (1894: pl. 26).

EXSICCATAE: Char. Amer. Exsicc. *28*, *29*, *30*; Phyc. Boreali-Amer., Fasc. XXIX, *1435*, Fasc. XXXIV, *1691*. Issued as duplicates from the herbarium of T. F. Allen

[34] Groves & Bullock-Webster (1920: 103).

apparently posthumously by the New York Botanical Garden: *W. G. Farlow*, 1870. Near Botanical Garden, Cambridge, Mass.; *J. W. Blankinship*, Aug. 26, 1893. Poley's meadow, Canaan Forks, Queen County, New Brunswick, Canada; *W. G. Farlow*, May 12, 1882. Fresh Pond, Cambridge, Mass.; *Blankinship*, Aug. 6, 1892. Sequoia Canon, Marin Co., California.

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Indiana, Daily (1945: 126); — Maine, Collins *in* Rand & Redfield (1894: 227); — Massachusetts, Halsted (1879: 175), Robinson (1880: 146), Braun (1883: 34), Dame and Collins (1888: 151), Owen (1888: 74); — Michigan, Bach (1907: 126); — Nebraska, Webber (1892: 20), Woods (1894: 124); — New Jersey, Braun (1883: 34), Allen *in* Britton (1889: 356); — New York, Braun (1883: 34), Burnham & Latham (1923: 4), Grier (1924–5: 60); — Ohio, Braun (1883: 34).

TYPE LOCALITY: Europe.

The name *flexilis* is considered to have been first validly published by Linnaeus (1753: 1157). *Chara flexilis* Linn. was transferred to the genus *Nitella* by Agardh (1824: 124). Agardh's statement "Chara flexilis, Linn. (*quoad partem*)" indicates that only a portion of the plants designated by Linnaeus as *C. flexilis* was to be included within his definition of *N. flexilis*. Thus, the name *Nitella flexilis* (Linn. pro parte) Agardh has been established in the literature.

Nitella flexilis var. **longifolia** Braun apud Migula

Nitella flexilis var. *longifolia* Braun, Consp. Syst. Char. Europ. p. 2. 1867. (nom. nud.). —Braun apud Migula *in* Rabenhorst, Krypt.-Fl. Deutschl. ed. 2: **5**: 138. 1897.

LITERATURE FOR NORTH AMERICA:

Nitella flexilis forma *longifolia, elongata*: Allen, Char. Amer. **1**: 7. 1888.

The variety is to be distinguished from the species in that the branchlets are 1½ times as long as the internodes of the axis; the plant being larger, less fully branched, less heavily fertile; and the plant generally forming more numerous individual plants from the substratum so as to give a bushy appearance in the field.[35]

ILLUSTRATIONS: Allen (1892: pl. 6, fig. 2).

EXSICCATAE: Char. Amer. Exsicc. *29*.

DISTRIBUTION FOR NORTH AMERICA: **United States:** — New York, Allen (1880: *29*, exsicc.).

TYPE LOCALITY: Europe.

The earliest reference to this name that has come to the attention of the author is Braun (1867: 2), but is without description. The first actual description which has been found is by Migula (1897: 138), with Braun cited as the author. Thus, unless some earlier description is found among Braun's works, the citation for this species must be changed to read *Nitella flexilis* var. *longifolia* Braun apud Migula.

The name *N. flexilis* forma *longifolia, elongata*, which is to be found in Allen's works (1888: 7; 1880: No. *29*, exsicc.), so far as has been found

[35] Migula *in* Rabenhorst (1897: 138).

by the author, lacks description or earlier publication. As such, it is considered a *nomen nudum*. Further consideration of the necessity of this *elongata* must await monographic treatment. In any case, it appears that Allen was mistaken in designating *longifolia* as a form instead of a variety, under which it was originally and subsequently published.

Nitella flexilis var. **nidifica** (Hartman) Groves, H. & J.

Chara nidifica Hartman, Sk. Fl., ed. 5, 1846.
Nitella flexilis γ *nidifica* Wallman, K. Vets.-Akad. Handl. (1852): 262. 1854.
Nitella flexilis var. *nidifica* Groves, H. & J., Journ. Bot. **21**; rep. p. 3. 1884.

LITERATURE FOR NORTH AMERICA:

Nitella flexilis var. *nidifica*: Allen, Char. Amer. **2**: 11, pl. V-a. 1880. — Robinson, Fl. Essex Co., Mass. p. 146. 1880.
Nitella flexilis var. *subcapitata* (Braun ex Rabenhorst) Crépin, Bull. Soc. Bot. Belg. **2**: 129. 1863. (= *N. flexilis* var. *nidifica*, according to Groves (1883: rep. p. 3)). — Allen, Bull. Torrey Bot. Club **2**(3): 9. 1871. — Char. Amer. **2**: 11. 1880. — Char. Amer. **1**: 7. 1888. — Owen, Pl. Nantucket, p. 74, 1888.

Fertile branchlets very short, forming compact heads. Sterile branchlets often simple.[36]

ILLUSTRATIONS: Allen (1880: pl. V, fig. a).

EXSICCATAE: Char. Amer. Exsicc. *30*, as *N. flexilis* var. *subcapitata*.

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Connecticut, Allen (1871: 9; 1880: 11); — Massachusetts, Robinson (1880: 146), Owen (1888: 74). These record *N. flexilis* var. *subcapitata*.

TYPE LOCALITY: Europe.

The first description of this plant appears to have been published by Hartman (1846) as *C. nidifica*. Wallman (1854: 262) transferred this plant to the genus *Nitella*, at which time he also reduced it to the status of a form of *N. flexilis*.

Nitella flexilis forma **subnidifica** Allen (nom. dub.)

Nitella flexilis forma *subnidifica* Allen, Char. Amer. **2**(1): 6, pl. 6, fig. 2. 1892.

LITERATURE FOR NORTH AMERICA:

Nitella flexilis forma *subnidifica*: Allen, l.c.

This form is to be distinguished from the species in bearing abundant gametangia, and having oospores with smooth membrane and sharply flanged ridges.[37]

ILLUSTRATIONS: None.

EXSICCATAE: Char. Amer. Exsicc. *41*.

DISTRIBUTION FOR NORTH AMERICA: **United States**: — California, Allen (1892: 6) (TYPE LOCALITY ?, San Francisco, cf. Char. Amer. Exsicc. *41*).

It is decidedly questionable whether Allen (1892: 6) actually meant to establish this form as a taxonomic entity, in the light of his discussion which is contained in the footnote concerning the use of form names

[36] Groves, H. & J. (1883: rep. p. 3).
[37] Allen (1892: 6).

as a convenient manner in which to designate variations, on the first page of his article. It seems more likely that it was meant as a descriptive term. In any case, his description, accompanied by figures and exsiccatae material, might be considered to form a perfectly valid publication for the new name. Whether Allen considered this form a member of any particular variety is not made clear.

Nitella flexilis var. **crassa** Braun

Nitella flexilis var. *crassa* Braun *in* Braun, Rabenh. & Stiz., Die Char. Europ. (exsicc.), No. *101* (descr.?). 1857–78. — Braun, Abh. k. Akad. Wiss. Berlin (1882): 35. 1883.

LITERATURE FOR NORTH AMERICA:

Nitella flexilis var. *crassa*: Allen, Char. Amer. **2**: 12, pl. V–5. 1880. — Braun, Abh. k. Akad. Wiss. Berlin (1882): 35. 1883.

Plant up to 15 cm. high. Branchlets about half the length of the stem internodes; rays very stout, nearly equal to the stem in diameter; usually once divided though occasionally undivided; secondary rays about ⅓ as long as the primary rays, and about ½ as thick.[38]

ILLUSTRATIONS: None.

EXSICCATAE: None [?].

DISTRIBUTION FOR NORTH AMERICA: **United States:** — Iowa, Allen (1880: 12); — Vermont, Allen (1880: 12); **Canada:** — Allen (1880: 12).

For North America, Braun (1883: 35).

TYPE LOCALITY: Europe.

The original variety description apparently appeared on the label on Braun, Rabenhorst, and Stizenberger's exsiccata specimen, No. *101*.

12. Nitella Blankinshipii Allen

Nitella Blankinshipii Allen, Char. Amer. **2**(1): 5. 1892.

LITERATURE FOR NORTH AMERICA:

Nitella Blankinshipii: Allen, l.c., p. 1. — Bull. Torrey Bot. Club **23**: 7. 1896.

Plant dioecious, delicate, not over 5–10 cm. high. **Branchlets** 8 in a whorl, once divided, all similar except in rare instances of unequal size (heterophyllous); cells with very thin walls, tending to become dilated; primary ray 300 μ in diameter. **Dactyls** variously 2–4, 1–celled (?). **Gametangia** borne on separate plants. **Oogonia** usually solitary; **coronula** persistent. **Oospores** 450 μ long by 400 μ wide; **striations** of 6–7 sharp, prominent ridges; **membrane** roughened by scattered granules of irregular size. **Antheridia** 600 μ in diameter.[39]

ILLUSTRATIONS: Allen (1892: pl. 4).

EXSICCATAE: Char. Amer. Exsicc. *43*.

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Missouri, Allen (1892: 5; 1896: 7) (TYPE LOCALITY).

[38] Migula (1897: 139).

[39] Allen (1892: 5).

The description by Allen (1892: 5) is based on the specimen cited as ". . . gathered in Missouri by Mr. Blankinship."

Groves, H. and J. (1911: 31, footnote) suggested the advisability of uniting this species with *N. montana* Allen, *N. missouriensis* Allen, and *N. subglomerata* Braun into a single species under *N. acuminata* Braun.

13. Nitella montana Allen

Nitella montana Allen, Char. Amer. **2**(1): 4. 1892.
Nitella montanae Allen, Bull. Torrey Bot. Club **19**: 230. 1892. (nom. nud.).

LITERATURE FOR NORTH AMERICA:
Nitella montana: Allen, Char. Amer. **2**(1): 1 (key), 4 (descr.), pl. 3. 1892.
Nitella montanae: Allen, l.c.

Plant dioecious, delicate and branched, 3–7 cm. high. **Branchlets** 8 in a whorl, once divided. Occasional additional short shoots may be present in whorl. **Dactyls** 1–3, 1–celled, gradually tapering to elongated point. **Gametangia,** sexes occurring on different plans, not enveloped in mucus. **Oogonia** numerous, 1–3 together at a division of the branchlets; **coronula** persistent. **Oospores** 440 μ long by 390–400 μ broad; **striations** of 7–8 somewhat blunt ridges; **membrane** finely and evenly granular. **Antheridia** 750 μ in diameter.[40]

ILLUSTRATIONS: Allen (1892: pl. 3).

EXSICCATAE: Issued as duplicates from the herbarium of T. F. Allen apparently posthumously by the New York Botanical Garden: *Williams*, Aug. 25, 1891. Great Falls, Montana (Sand Coulee Lake).

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Montana, Allen (1892: 5) for Crater Lake, Mt. Agassiz (TYPE LOCALITY) and Great Falls, Sand Coulee.

Allen's first note on this species (1892: 230) cited his intention to describe, along with other new species, a "Nitella montanae." In the actual description, however, he changed the ending to "*Nitella Montana*," based on the specimen cited as ". . . from Crater Lake, Mt. Agassiz, gathered by U. S. Geol. Survey. Later by Mr. Williams from Sand Coulee, Montana."

Groves (1911: 31, footnote) suggested the advisability of uniting this species with *N. Blankinshipii* Allen, *N. missouriensis* Allen, and *N. subglomerata* Braun into a single species under *N. acuminata* Braun.

14. Nitella occidentalis Allen

Nitella occidentalis Allen, Bull. Torrey Bot. Club **21**: 166. 1894.

LITERATURE FOR NORTH AMERICA:
Nitella occidentalis: Allen, l.c., pl. 187. 1894.

Plant dioecious, 8–10 cm. high. **Branchlets** 6 in a whorl, once furcate. **Dactyls** (number not given), 1–celled, acuminate. **Gametangia** 2–3 together at the branchlet nodes, not enveloped in mucus. **Oogonia** (data not given). **Oospore** 345–390 μ long, 320–365 μ broad; **striations** of

[40] Allen (1892: 4).

6 not prominent ridges; **membrane** roughened with elevations, ridges, and depressions. **Antheridia** about 800 μ in diameter.[41]

ILLUSTRATIONS: Allen (1894: pl. 187).

EXSICCATAE: Issued as an unnumbered specimen under the herbarium label title "Characeae Americanae Exsiccatae," presumably posthumously by the New York Botanical Garden: *J. W. Blankinship*, June 1, 1893. Lake County, Calif. Other specimens, apparently from the same collection, were issued as duplicates from the herbarium of T. F. Allen by the same institution.

DISTRIBUTION FOR NORTH AMERICA: **United States**: — California, Allen (1894: 166) for Lake County (TYPE LOCALITY).

This species was described by Allen (1894: 166) based on the specimen cited as "Collected by Mr. Blankinship, in California, Lake County, June 1893." The only further reference to this species that the writer could find in the literature is the work of Groves, H. and J. (1911: 31), who did not alter the original status of the species.

15. Nitella stellaris Allen

Nitella stellaris Allen, Bull. Torrey Bot. Club **23**: 534. 1896.

LITERATURE FOR NORTH AMERICA:

Nitella stellaris: Allen, l.c., p. 534, 536, pl. 285.

Plant monoecious, about 25 cm. high. **Branchlets** 8 in a whorl, once divided. **Dactyls of sterile branchlets** 2–4, short, 1–celled, gradually acuminate. **Dactyls of fertile branchlets** 2 (rarely 3), short, 1–celled, gradually acuminate. **Gametangia** aggregated on the branchlet node; mucus (?) (data not given). **Oogonia** aggregated at branchlet nodes (dimensions not given). **Oospores** 230–240 μ long, 225 μ broad; **striations** of 5–6 sharp ridges; **membrane** quite smooth. **Antheridia** about 215 μ in diameter.[42]

ILLUSTRATIONS: Allen (1896: pl. 285).

EXSICCATAE: None issued. Specimen: *J. W. B[lankinship]*, *3*, Aug. 21, 1895. In pond near Verdigris River, Creek Nation, Indian Territory (NY). (co-type ?).[43]

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Oklahoma, Allen (1896: 534) for a pond near Verdigris River, Creek Nation, Indian Territory (TYPE LOCALITY).

This new species was described by Allen (1896: 534) based on the specimen cited as ". . . collected by Mr. J. W. Blankinship, in a pond near Verdigris river, Creek Nation, Indian Territory, August 21, 1895." The significance of this species has been questioned by Zaneveld (1940: 57), who suggests that it be lumped along with *N. capitulifera* Allen and *N. subspicata* Allen into *N. acuminata* var. *subglomerata* Braun.

[41] Allen (1894: 166).

[42] Allen (1896: 534).

[43] At the time of the writer's inspection of the material in this herbarium, the types were apparently in the hands of G. O. Allen of England. As this specimen was not marked "type," it is assumed that the type was absent, and thus this duplicate material may be a co-type.

16. Nitella acuminata Braun ex Wallman

Nitella acuminata var. *Bélangeri*[44] Braun, Hooker's Journ. Bot. **1:** 292. 1849.
Nitella acuminata Wallman, K. Vets.-Akad. Handl. (1852): 263. 1854.

LITERATURE FOR NORTH AMERICA:

Nitella acuminata: Allen, Bull. Torrey Bot. Club **2**(3): 9. 1871. — Char. Amer. **2**: 10. 1880. — Char. Amer. **1**: 41 (key). 1888. — *in* Mohr, Contrib. U. S. Nat. Herb. **6:** 147. 1901. — (cf. also under subspecies and varieties).
Division *Acuminatae*: Allen, Char. Amer. **2**(1): 7. 1892.

Plant monoecious, bright to brownish green, up to 25 cm. high. Stem moderately stout, 700–1500 μ in diameter. Internodes as long as up to 1½ times the length of the branchlets. **Sterile branchlets** 6–8 in a whorl, up to 4 cm. long, well developed; in adult specimens curving outward, once furcate; primary rays ⅔–¾ the length of the entire branchlet; secondary rays 2–3, seldom 4, much shorter than the primary rays, extremely variable in length. **Fertile branchlets** commonly forming dense heads, 2–3 such heads arising within a whorl; these branchlets sometimes bear not only compact heads but also a whorl of 6–8 longer fertile branchlets, about 1 cm. long, whereas the heads are about 0.2 cm. in diameter; both kinds of fertile branchlets are once furcate into 2 (–3) short, ultimate rays, not enveloped in mucus. **Dactyls of sterile branchlets** (2–) 3, up to 1 cm., unequal or equal in length, 1–celled, gradually tapering to an acuminate point. **Dactyls of fertile branchlets** 2–3, 1–celled, much shorter than those of sterile branchlets, up to 0.2 cm. long, and more or less conical. **Dactyls of fertile heads** 2–4, 1-celled, up to 790 μ long and 125 μ wide at the base. **Gametangia** occur together at the branchlet nodes, not enveloped in mucus. **Oogonia** 1–2 together, sessile, 280–510 μ long (including coronula), 240–400 μ wide; spiral cells showing 8–9 convolutions; **coronula** persistent, 33–85 μ high, 45–130 μ wide at the base, individual cells strongly converging. **Oospores** dark chestnut-brown, subdiaphanous (in dried specimens nearly black), 275–340 μ long, 225–300 μ wide; **striations** of (6–) 7 (–8) ridges; **membrane** minutely granular, diaphanous. **Antheridia** 230–310 μ in diameter.[45]

ILLUSTRATIONS: Braun (1883: pl. 1, fig. 22–26, pl. 4, fig. 88), Allen (1892: pl. 7).

EXSICCATAE: cf. under subspecies and varieties.

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Alabama, Allen *in* Mohr (1901: 147).[46] (Cf. under subspecies and varieties).

TYPE LOCALITY: Africa, Reunion (Île de la Réunion — formerly Île Bourbon), Wallman (1854: 263).[47]

[44] Zaneveld (1940: 60) has listed sufficient evidence to show that Braun's (1849: 292) original spelling of *Bellangeri* was an orthographic error, as the collector's name was Bélanger. Braun (1859: 355; 1868: 877) rectified this spelling in certain of his later works.

[45] Zaneveld (1940: 54).

[46] This record is foreign to Allen's general policy of determining members of his *Acuminatae* to groupings with much finer distinctions. A study of the specimen will doubtlessly show the plant to fall into one of the subspecific forms.

[47] The type locality of Braun's (1849: 293) specimen upon which he described *N. acuminata* var. "*Bélangeri*" is cited as "In pools near *Gengu* on the coast of Coromandel, ... [India]."

Braun (1849: 292) is usually cited as the original author of this species. Actually, Braun did not describe the species until 1868, in his "Die Characeen Afrika's" (1868: 876), and in this work he cited the name in the description as a subspecies of *N. flexilis*. Braun (1883: 35) returned to his original usage of the distinct species in his "Fragmente einer Monographie der Characeen." The first valid publication of the species was by Wallman (1854: 263), in which he cited the earlier work of Braun accurately as "*Nitella acuminata* (Braun, id.) [= ined. ?]." Wallman based his description on the specimen cited as "Afrika, Isle Bourbon! Commerson." In accordance with Arts. 41 and 44 of the "International Rules of Botanical Nomenclature" (1935: 11, 12) which specify that "A group is not characterized, and the publication of its name is not validated, merely by mention of the subordinate groups included in it," Braun's (1849: 292) name cannot be considered validly published on the basis of his *N. acuminata* var. *Bélangeri* alone. For this reason, Wallman's description is the first validly published work.

Allen (1892: 7) proposed that, as the species *N. acuminata* encompassed so many distinct homogeneous groups, it should be raised to a division *Acuminatae*. As a result of his decision, he proceeded to raise the earlier subspecific entities to full species rank. Among those elevated on this basis are *N. glomerulifera*, *N. subglomerata*, and *N. Lindheimeri*. Among new species which he described within this group are apparently *N. stellaris*, *N. subspicata*, and *N. missouriensis*. As far as is known to the writer, no other monographer has seen fit to follow Allen's proposal, and Zaneveld (1940: 57) has outlined a much more conservative treatment (cf. under these species, subspecies, and varieties).

KEY TO THE SUBSPECIFIC FORMS OF *NITELLA ACUMINATA*

1a. Sterile branchlets not much longer than the fertile whorls; fertile whorls forming rather loose heads ..... (2)

1b. Sterile branchlets much longer than the fertile whorls; fertile whorls forming dense heads ..... subspecies *glomerulifera*

2a. Branchlets 5–6 in a whorl; fertile branchlets 2–3 mm. long, 330–500 μ in diameter ..... variety *Lindheimeri*

2b. Branchlets 6–8 in a whorl; fertile branchlets exceeding limits for preceding variety ..... variety *subglomerata* ..... (3)

3a. Dactyls ½ to ¼ as long as the primary rays ..... variety *subglomerata* (typical form)

3b. Dactyls up to ⅛ as long as primary ray ..... variety *subglomerata* forma *brachyteles*

Nitella acuminata var. **Lindheimeri** Braun

Nitella acuminata var. *Lindheimeri* Braun, Hooker's Journ. Bot. **1**: 293. 1849. (nom. nud.). — Abh. k. Akad. Wiss. Berlin (1882): 38. 1883.

Nitella Lindheimeri Braun, Monatsber. k. Akad. Wiss. Berlin (1858): 355. 1859. (brief text descr.).

LITERATURE FOR NORTH AMERICA:

Nitella acuminata var. *Lindheimeri*: Braun, Hooker's Journ. Bot. **1:** 293. 1849. — Abh. k. Akad. Wiss. Berlin (1882): 38. 1883. — Allen, Char. Amer. **1**: 43 (key). 1888.

Nitella Lindheimeri: Braun, Monatsber. k. Akad. Wiss. Berlin (1858): 355. 1859. — Allen, Char. Amer. **2**(1): 7. 1892. (as a spec. dub.).

Branchlets 5–6 in a whorl. Fertile branchlets 2.5–3 mm. long, 330–500 μ in diameter. Oogonia aggregate, at least 2 together.[48]

ILLUSTRATIONS: None.

EXSICCATAE: None issued. Specimen: (non vidi).

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Missouri, Braun (1849: 293); — Texas, Braun (1849: 293; 1859: 355; 1883: 38), Allen (1892: 7). Braun (1883: 38) cites Lindheimer's specimen for Friedrichsburg (TYPE LOCALITY ?).

This plant was first described by Braun (1859: 355) in a brief statement based on the specimen cited as "N. Lindheimeri aus Texas." The first complete treatment for this species in the literature appears to have been made in his "Fragmente einer Monographie der Characeen" (1883: 38) for the specimen (apparently identical to the above) cited as "Friedrichsburg in Texas (Lindheimer)."

Zaneveld (1940: 59) included this entity within the limits of *N. acuminata* var. *Bélangeri* Braun. He delimited this variety based on Braun's original type [49] as follows:

> Plants with very short dactyls, in the type specimen hardly visible with the naked eye, in other specimens up to as long as the diameter of the stem.

Allen followed Braun's (1883: 38) designation of this plant as a variety in his early papers; but he (1892: 7) not only returned to Braun's original usage as a full species, but stated that from the specimens he had seen it was apparently identical to *N. subglomerata* (= *N. acuminata* var. *subglomerata*). He, in essence, left it as a doubtful species.

Nitella acuminata var. **subglomerata** Braun

Nitella subglomerata Braun, Monatsber. k. Akad. Wiss. Berlin (1858): 356. 1859.

Nitella acuminata β *subglomerata* Braun, Abh. k. Akad. Wiss. Berlin (1882): 36. 1883.

LITERATURE FOR NORTH AMERICA:

Nitella acuminata var. *glomerata*: Webber, Trans. Acad. Sci. St. Louis **6**: 20. 1892. (= *subglomerata*, fide Daily (1944: 152)).

Nitella acuminata var. *subglomerata*: Allen, Bull. Torrey Bot. Club **2**(3): 9. 1871. — Char. Amer. **2**: 10. 1880. — Braun, Abh. k. Akad. Wiss. Berlin (1882): 36. 1883. — Allen, Char. Amer. **1**: 40 (fig. 44), 41 (key). 1888. — Nordstedt, Lunds Univ. Årsskr. **25**(4): 7. 1889.

Nitella subglomerata: Allen, Char. Amer. **2**(1): 2 (key), 7, pl. 7, 7a. 1892. — Woods, Fl. Nebraska, p. 123. 1894. — Daily, Butler Univ. Bot. St. **6**: 151. 1944.

[48] Braun (1883: 38).

[49] Bélanger. 1826–'28. In pools near Gengu, Coromandelia, India. (B).

Dactyls of sterile branchlets macroscopically visible, longer than 650 μ. Primary rays up to ¾ as long as the secondary ray. Dactyls of the fertile branchlets very short.[50]

ILLUSTRATIONS: Allen (1892: pl. 7, 7a), Braun (1883: pl. 1, fig. 22–26), Woods (1894: pl. 25).

EXSICCATAE: Issued as duplicates from the herbarium of T. F. Allen posthumously by the New York Botanical Garden: *J. W. Blankinship*, 1893. Missouri. Certain specimens were also issued with a label "Characeae Americanae Exsiccatae," but without numbers.

DISTRIBUTION FOR NORTH AMERICA: **Mexico:** — near Mexico City, Braun (1883: 36), Allen (1892: 7); **United States**: — Illinois, Nordstedt (1889: 7), Braun (1883: 36), Allen (1892: 7); — Missouri, Allen (1892: 7); — Nebraska, Webber (1892: 20), Woods (1894: 123), Daily (1944: 151); — New Jersey, Allen (1892: 7); — New York, Allen (1892: 7); — Ohio, Braun (1883: 36); — Oregon, Allen (1892: 7); — Pennsylvania, Braun (1883: 36), Allen (1892: 7); — Texas, Braun (1883: 36), Allen (1892: 7).

TYPE LOCALITY: Panama (K).[51]

The first published description of this plant was by Braun (1859: 356) based on the specimen cited as "Prope Panama in consortio *Nit. microcarpae* 1846 legit Duchassaing (Herb. Hook.)." In his "Fragmente einer Monographie der Characeen" (1883: 36) he reduced it to a subspecific status, but did not indicate whether he proposed a rank of variety, subspecies, or form. Allen (1871: 9) followed Braun's later treatment by considering the plant a variety, but changed his mind (1892: 7) and returned to Braun's original concept of considering it a full species. Zaneveld (1940: 61), in monographing the Malaysian Charophyta, retained the variety status.

Nitella acuminata var. **subglomerata** forma **brachyteles** Braun

Nitella acuminata β subglomerata forma *brachyteles* Braun, Abh. k. Akad. Wiss. Berlin (1882): 37. 1883.

LITERATURE FOR NORTH AMERICA:

Nitella subglomerata var. *brachyteles*: Allen, Char. Amer. **2:** 10. 1880. (nom. nud.). — Braun, l.c. (descr.). — Allen, Char. Amer. **2**(1): 7. 1892.

Nitella acuminata brachyteles: Allen *in* Mohr, Contrib. U. S. Nat. Herb. **6**: 147. 1901.

This form is characterized by the greatly abbreviated terminal segments of the branchlets.[52]

ILLUSTRATIONS: Braun (1883: pl. 1, fig. 25).

EXSICCATAE: None issued. Specimen: *Mohr*. Sept. 1881. Gently flowing deep or shallow water. Delta, Mobile River (NY).

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Alabama, Allen (1892: 7), Allen *in* Mohr (1901: 147); — Missouri, Braun (1883: 37) for pond on the hills N. West of St. Louis (TYPE LOCALITY), Allen (1892: 7) for the same specimen.

[50] Zaneveld (1940: 61).
[51] (K), "Herb. Hook[er]," fide Braun (1859: 356).
[52] Allen (1892: 7).

This form was described by Braun (1883: 37) as *N. acuminata β subglomerata* forma *brachyteles* based on the specimen cited as "Pond on the hills N. West of St. Louis (Aug. 1846 A. Fendler; Sept. 1848, Engelmann.)." Allen reported this form both as a variety of *N. subglomerata* and *N. acuminata*; but, as there seems to be no stated logic for these moves, the writer has retained the original form of the name. Zaneveld (1940: 59) included this form under *N. acuminata* var. *Bélangeri* Braun (cf. var. *Lindheimeri*).

Nitella acuminata subsp. **glomerulifera** Braun

Chara flexilis subsp. *glomerulifera* Braun, Amer. Journ. Sci. & Arts **46**: 92. 1844. (nom. nud.), as = ? *N. flexilis* f. (?).

(Non) *Chara glomerulifera* Ruprecht, Beiträge Pfl. russ. Reiches **3**: 7. 1845. (= *Tolypella glomerata* (Desv.) Leonhardi (fide Braun (1868: 877) and Groves, H. & J. (1880: 162)).

(Non) *Nitella flexilis δ glomerulifera* Kützing, Spec. Alg., p. 514. 1849. (= *T. glomerata*).

(Non) *Nitella glomerulifera* Kützing, Tab. Phyc. **7**: 32, pl. 81. 1857. (= *T. glomerata* (Desv.) Leonh., fide Groves (1880: 162)).

Nitella acuminata subsp. *glomerulifera* Braun, Abh. k. Akad. Wiss. Berlin (1882): 39. 1883.

LITERATURE FOR NORTH AMERICA:

Chara flexilis subsp. *glomerulifera*: Braun, l.c.

Nitella acuminata subsp. *glomerulifera*: Braun, l.c. — Allen, Char. Amer. **1**: 40 (fig. 45), 43 (key). 1888. -- Nordstedt, Lunds Univ. Årsskr. **25**(6): 23. 1889.

Nitella capitata: Halsted, Proc. Boston Soc. Nat. Hist. **20:** 173. 1879. (fide Braun (1883: 39)).

Nitella flexilis δ glomerulifera: Kützing, Spec. Alg. p. 514. 1849. — Wallman, K. Vets.-Akad. Handl. (1852): 262. 1854. (= *T. glomerata*).

Nitella flexilis var. *nidifica*: Robinson, Fl. Essex Co., Mass. p. 146. 1880. (Syn.: *C. glomerulifolia* A. Br. [misspelled for *C. glomerulifera* Braun]).

Nitella glomerulifera: Allen *in* Britton, Final Rep. State Geol. (N. Jersey) **2**: 356. 1889. — Allen, Char. Amer. **2**(1): 8 (descr.), pl. 8. 1892. — Bull. Torrey Bot. Club **23**: 534. 1896.

This subspecies is readily distinguished from the species and other subspecific forms of *N. acuminata* by the dense masses of fruiting whorls which are collected into heads attaining a diameter of 8–10 mm., and are subtended by simple or once-divided sterile branchlets which long overtop the heads. Sterile branchlets often 40 mm. long. Oospore membrane thickly studded with roundish elevations or granules, averaging 1.5 μ in diameter. These markings are diagnostic in themselves.[53]

ILLUSTRATIONS: Allen (1892: pl. 8), Nordstedt (1889: pl. 1, fig. 14, 15, for membrane).

EXSICCATAE: Char. Amer. Exsicc. *32*. Issued as duplicates from the herbarium of T. F. Allen apparently posthumously by the New York Botanical Garden: *T. F. Allen*, 1882. Sodus Bay, Lake Ontario.

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Louisiana, Allen (1892: 8); — Massachusetts, Braun (1883: 39), Nordstedt (1889: 23), Allen (1892: 8); — New

[53] Allen (1892: 8).

Hampshire, Braun (1883: 39); — New Jersey, Allen (1892: 8); — New York, Allen (1892: 8); — Ohio, Allen (1892: 8).

TYPE LOCALITY: Merrimac River, Massachusetts (or New Hampshire ?).

The name *Chara glomerulifera* [A. Br., ined.] was first employed by Braun (1844: 92) but without description (*nomen nudum*). Ruprecht (1845: 7) described a different plant under this name, *C. glomerulifera* (= *Tolypella glomerata* (Desv.) Leonhardi). Kützing (1849: 514) transferred Ruprecht's plant to the genus *Nitella*, as *N. flexilis δ glomerulifera* (= *T. glomerata*). The first description of Braun's original plant appeared in Braun's "Fragmente einer Monographie der Characeen" (1883: 39) as *Nitella acuminata* subsp. *glomerulifera* based on the specimen cited as "'Amer. Sept. Green.' Herb. Decaisne. 'In the Merrimakriver' also in New-Hampshire oder Massachussets, wahrscheinlich aus Massachussets, wo der Merrimakfluss Boston am nächsten ist, indem Green bei Boston gesammelt hat."

Allen followed Braun in the use of the subspecific designation in his early works, but in his "Characeae of America" (1892: 8) raised it to the species *N. glomerulifera* (Braun) Allen.

17. Nitella missouriensis Allen (spec. dub.)

Nitella missouriensis Allen, Char. Amer. 2(1): 5. 1892.

LITERATURE FOR NORTH AMERICA:

Nitella missouriensis: Allen, l.c.

Plant (apparently) monoecious, diffusely branched, 15–20 cm. high. **Branchlets** (data not given in description, but plate shows 6–8). **Dactyls** 1–celled. **Gametangia** (data not given) without mucus. **Oogonia** (data not given). **Oospores** (data not given). **Antheridia** 650 μ in diameter.[54]

ILLUSTRATIONS: Allen (1892: pl. 5).

EXSICCATAE: Specimens have been issued which bear the label title "Characeae Japonicae Exsiccatae"[55] without number: *J. H. Kimmons*, June 1895. Springfield, Missouri.

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Missouri, Allen (1892: 5) for Springfield (TYPE LOCALITY).

As indicated by Allen's (1892: 5) description, this was considered a doubtful species. Groves, H. and J. (1911: 31, footnote) suggested the advisability of uniting this species with *N. Blankinshipii* Allen, *N. montana* Allen, and *N. subglomerata* Braun into a single species under *N. acuminata* Braun. Allen, on the other hand, states that it would be unhesitatingly referred to *N. subcapitata* (= *N. flexilis* var. *nidifica*) except that in *N. missouriensis* the fruits are entirely devoid of mucus.

[54] Allen (1892: 5).

[55] Wood, Farlowia **3**: 328. 1948, omits this specimen from Allen's "Char. Jap. Exsicc." on the grounds that it is an American collection and probably was intended to bear the label title "Char. Amer. Exsicc."

18. Nitella subspicata Allen

Nitella subspicata Allen, Bull. Torrey Bot. Club **23**: 6, pl. 253. 1896

LITERATURE FOR NORTH AMERICA:

Nitella subspicata: Allen, l.c.

Plant monoecious, 15–20 cm. high, diffusely branched. **Branchlets** once divided. **Sterile branchlets** widely spreading and diffuse. **Fertile branchlets** contracted into remotely spike-like heads arising within the whorls of sterile branchlets. **Dactyls** 3–4, 1–celled, long acuminate, somewhat inflated at the middle. **Gametangia** aggregated at the fertile branchlet node; mucus (?) (data not given). **Oogonia** 1–3 (generally 2) at a node; about 306 μ long. **Oospore** nearly black, 225 μ long, 200 μ broad; **striations** of 6 prominent ridges; **membrane** quite smooth. **Antheridia** about 240 μ in diameter.[56]

ILLUSTRATIONS: Allen (1896: pl. 253).

EXSICCATAE: Issued as duplicates from the herbarium of T. F. Allen apparently posthumously by the New York Botanical Garden: *J. W. Blankinship*, 1893. Springfield, Missouri. This specimen occasionally is accompanied by the label "Characeae Americanae Exsiccatae."

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Missouri, Allen (1896: 6) for Springfield (TYPE LOCALITY).

This species was described by Allen (1896: 6), based on a specimen cited as "Collected in Missouri by J. W. Blankinship."

The significance of this species has been questioned, and Zaneveld (1940: 57) suggests lumping it along with *N. stellaris* Allen and *N. capitulifera* Allen under *N. acuminata* var. *subglomerata* Braun.

19. Nitella hyalina (DeCandolle) Agardh, pro parte

Chara hyalina DeCandolle *in* Lamark, Fl. Franc. **6:** 247. 1805.[57]

Nitella hyalina (DC.) Agardh, Syst. Alg. p. 126. 1824.

LITERATURE FOR NORTH AMERICA:

Nitella hyalina: (cf. var. *Engelmanni*)

Plant monoecious, medium-sized, up to 30 cm. high. **Branchlets** about 24, of two distinct types, a longer whorl 2–3 times furcate, and 2 shorter central accessory whorls. **Dactyls** 4–5, uniformly 2-celled. **Accessory branchlets** of the upper row once furcate into 5 rays; those of the lower row once or twice furcate into 4–6 rays. **Gametangia** borne together at all nodes of the primary branchlets, and occasionally at the nodes of the accessory branchlets, solitary, enveloped in mucus. **Oogonia** (dimensions not given). **Oospores** reddish-brown, 250–335 μ long; **striations** of 6–7 ridges; **membrane** granulate. **Antheridia** 350–425 μ in diameter.[58]

[56] Allen (1896: 6).

[57] Certain editions were mistakenly dated 1815 instead of the correct 1805 (cf. Journ. Bot. p. 431. 1896).

[58] Zaneveld (1940: 108).

ILLUSTRATIONS: Groves & Bullock-Webster (1920: pl. 16).
EXSICCATAE: (cf. var. *Engelmanni*)
DISTRIBUTION FOR NORTH AMERICA: (cf. var. *Engelmanni*)
TYPE LOCALITY: Europe.

The species *Chara hyalina* was first described by DeCandolle *in* Lamark (1805: 247) based on the specimens cited as "trouvée aux environs de Lausanne, par M. Gay; du Mans, par M. Desportes; de Nantes, par M. Hectot." As discussed under *N. tenuissima*, Desvaux (1818: 14) challenged DeCandolle's name, thinking it a synonym of his species; and Braun (1835: 54) showed DeCandolle's specimens to include both Desvaux's plants and *C. hyalina* (= *N. hyalina*), thus confirming DeCandolle's name in part (*pro parte*). Agardh (1824: 126) transferred the plant to the genus *Nitella*.

Nitella hyalina var. **Engelmanni** Braun

Nitella hyalina var. *Engelmanni* Braun, Abh. k. Akad. Wiss. Berlin (1882): 79. 1883.

Nitella formosa Allen, Bull. Torrey Bot. Club **20**: 119. 1893. — ibid., p. 258. (= *N. hyalina*, near var. *Engelmanni*).

LITERATURE FOR NORTH AMERICA:

Nitella hyalina var. *Engelmanni*: Braun, l.c., p. 58. — Allen, l.c., p. 258.

Nitella formosa: Allen, l.c., p. 119.

Nitella hyalina: Allen, Char. Amer. **1**: 48 (key). 1888. — Stewart, Journ. Elisha Mitchell Sci. Soc. **53**: 175. 1937.

This variety differs from the species in that the whorl consists of larger, twice-divided, or occasionally smaller once-divided, more abundant branchlets.[59]

ILLUSTRATIONS: Stewart (1937: pl. 16–19).

EXSICCATAE: Char. Amer. Exsicc. *44*; Phyc. Boreali-Amer., Fasc. E, *CI*.

DISTRIBUTION FOR NORTH AMERICA: **Mexico**: — Tlalnepantla,[60] Allen (1893: 119); **United States**: — North Carolina, Stewart (1937: 175); — Texas, Braun (1883: 58, 79) (TYPE LOCALITY).

Braun (1883: 79) described this variety based on the specimen cited as "Texas (Lindheimer, Oct. 1845) comm. Engelmann." Allen (1893: 119) described *N. formosa* based on specimens from Mexico, but later (1893: 258) stated that it was to be included with *N. hyalina* and related to var. *Engelmanni*.

20. Nitella Leibergi Allen

Nitella Leibergi Allen, Char. Amer. **2**(3): 19. 1896.

LITERATURE FOR NORTH AMERICA:

Nitella Leibergi: Allen, l.c., p. 19, pl. 18.

Plant monoecious, up to 3–4 cm. high, diffusely branched. **Branchlets** 6 in a whorl, frequently heteromorphous, some undivided, some 1–2 times

[59] Braun (1883: 79).
[60] Type locality of *N. formosa* Allen.

divided; first branchlet node rarely fertile, the second usually fertile. **Dactyls** usually 4, 2–celled; apical cell a rather elongated mucro, 50 μ in diameter by 135–185 μ long; the penultimate cell generally tapers somewhat from about the middle to the base of the apical cell. **Gametangia** together at the second (rarely the first) branchlet node. **Oogonia** (frequently isolated) 390 μ long; **coronula** small and persistent. **Oospores** averaging 272 μ long by 175–240 μ wide; **striations** of 6 strong ridges; **membrane** marked with fine granules (doubtful, due to immaturity of specimens). **Antheridia** 200–300 μ in diameter.[61]

ILLUSTRATIONS: Allen (1896: pl. 18).

EXSICCATAE: None issued. Specimen: (non vidi).

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Oregon, Allen (1896: 20) for Button Springs, Lake Co. (TYPE LOCALITY).

The literature for this species is limited to the original description by Allen (1896: 19) based on the specimen cited as ". . . collected for the United States National Herbarium by J. B. Leiberg on June 30, 1894, in 'shallow pools which dry up in middle summer, under and among the submerged *Artemisia* shrubs, near Button Springs, Lake Co., eastern Oregon. Alt. 1470 meters.' "

21. Nitella capitellata Braun

(Non) *Chara capitata* Nees von Esenbeck, Denkschr. k. beierisch. bot. Gesell. **2**: 80. 1818. (= *N. capillaris* (Krocker) Groves & Bullock-Webster).

Chara capitata Elliott, Sketch of Bot. S. Carolina and Ga. **2**: 516. 1824.

Chara capitellata Elliott ex Braun, Amer. Journ. Sci. & Arts **46**: 93. 1844. (nom. nud.).

Nitella capitellata Braun, Abh. k. Akad. Wiss. Berlin (1882): 56. 1883.

LITERATURE FOR NORTH AMERICA:

Chara capitata: Elliott, l.c.

Chara capitellata: Braun, l.c.

Nitella capitellata: Braun, l.c. — Allen, Char. Amer. **1**: 46 (key). 1888. — ibid., **2**(3): 21, 22, pl. 20. 1896.

Plant dioecious or monoecious (unknown). **Sterile branchlets** 6 in a whorl; once divided. **Fertile branchlets** 6 in a whorl, shorter than sterile branchlets; once to three times divided; occasionally forming heads. **Gametangia** borne at first division of fertile branchlets. **Oogonia** solitary, 360–420 μ long, 270–300 μ wide. **Oospores** 230–250 μ long, 190–200 μ wide, dark brown; **striations** of 5 (?) (data taken from Allen's drawing) sharp-angled ridges; **membrane** (unknown). **Antheridia** (unknown).[62]

ILLUSTRATIONS: Braun (1883: pl. 1, fig. 43–46), Allen (1896: pl. 20).

EXSICCATAE: None issued. Specimen: (non vidi).

DISTRIBUTION FOR NORTH AMERICA: **United States:** — Georgia, Elliott (1824: 516) for rice fields on the Ogeechee River (TYPE LOCALITY), Braun (1883: 57), Allen (1896: 21); — Texas, Braun (1883: 58).

[61] Allen (1896: 19).

[62] Allen (1896: 21).

This species is based upon two plants, and a possible third, as stated by Braun (1883: 56). The original description for the plant by Elliott (1824: 516) for *C. capitata* was based on the specimen cited as "Grows in ditches — common in the rice fields on the Ogeechee River. Flowers April–May."

Braun (1844: 92), not being able to obtain the original description or plant, listed the name *Chara capitellata* Elliott as suggested by Schweinitz through courtesy to Elliott, despite the fact that Elliott's description as a later homonym of *C. capitata* Nees von Esenbeck had no valid status. Prior to this time, Braun had used *Chara tenella* Braun (ined.) to designate this species, and during 1846 employed *C. Ellioti* Braun (ined.). However, in his "Fragmente einer Monographie der Characeen" (1883: 56) he redescribed the plant completely under *Nitella capitellata* Braun.

Braun's species was based on the specimen cited as ". . . Georgia (gesammelt von Le Conte). Herb. Richard, als *Ch. nidifica*," with collecting data as "Grows in ditches. Common in rice fields on the Ogeechee river, Georgia," quoted from Elliott. He cited also LeConte's specimen in "herb. Zeyher" without locality. A third specimen was cited as in "herb. Martius," sent by L. V. Schweinitz under the name *C. capitellata* Ell. without locality, which was apparently identical to the specimen in "herb. Richard."

22. Nitella capillata Braun, spec. dub.*

Nitella capillata Braun, Monatsber. k. Akad. Wiss. Berlin (1867): 893. 1868.

LITERATURE FOR NORTH AMERICA:

Nitella capillata: Braun, l.c. — Abh. k. Akad. Wiss. Berlin (1882): 91, pl. 2, fig. 64–68. 1883. — Allen, Char. Amer. **1**: 49 (key). 1888.

Plant monoecious, similar in habit to *N. mucronata* subsp. *virgata* (Wallman) Braun, and *N. myriotricha* Braun (New Holland). **Branchlets** 6 in a whorl. **Sterile branchlets** 35–45 mm. long, 3 (–4) times divided. **Fertile branchlets** 1½–3 mm. long, forming dense heads; whorls 5–6 in a row on a stem, forming short spikes. **Dactyls** (number not given) 3– (rarely 2–) celled; apical cell blunt and short. **Gametangia** borne at all branchlet nodes, antheridia lacking at last division of branchlets. **Oogonia** solitary at all divisions of fertile branchlets, 220–250 μ long, 180–220 μ wide (an immature oogonium); **coronula** short; envelop-

* At the time of preparation of this manuscript, the writer received notice of a paper in press on this species. Mrs. Daily will report specimens collected in abundance by *Dr. L. A. Whitford 3*, (Univ. N. Carolina) May 24, 1941; *No.* —, April 19, 1946. In the swift outflow from Partin's Mill Pond, 20 miles south of Raleigh [North Carolina] (F) (FH) (Miss) (NY) (US) and Herb. F. K. Daily. Her more complete description of these plants adds the following information to Braun's original descriptions: dactyls 3, 3–4-celled, blunt to pointed; oogonia solitary, coronulae 16 μ broad, 21 μ long; oospore 221 x 198 μ, striae of 8–9 not prominent ridges; membrane irregularly reticulate, reticulae about 10 m μ in diameter; antheridia long stipitate, up to 318 μ in diameter. Ref.: **Daily, F. K.** 1948 (in press). Nitella capillata A. Br. in North Carolina. Butler Univ. Bot. St. **8**: .... 1948.

ing cells showing 6 convolutions. **Oospores** (no data given, no ripe oospores seen by Braun); **striations** (data not given); **membrane** (data not given). **Antheridia** borne on long stipes (?), occurring at all branchlet nodes except the last; about 200 μ in diameter.[63]

ILLUSTRATIONS: Braun (1883: pl. 2, fig. 64–68).

EXSICCATAE: None issued. Specimen: (non vidi).

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Louisiana, Braun (1883: 92) for New Orleans (TYPE LOCALITY).

The name *capillata* first occurred in the literature with a meager description by Braun (1868: 893). It was described in greater detail by Braun (1883: 91) as a doubtful species based on the specimen cited as "'New Orleans; (Riddell, A. Wood dedit 1859),' G. Engelmann 1860 oder 1861 unter dem Namen *Ch. capitata* ein einziges Exemplar."

23. Nitella annularis Allen

Nitella annularis Allen, Char. Amer. **2**(2): 16. 1894.

LITERATURE FOR NORTH AMERICA:

Nitella annularis: Allen, l.c.

Plant monoecious (?), 15–22 cm. high, branched and forming intricate masses. Nodes of axes and branchlets swollen and thickened, readily fragmenting.[64] **Sterile branchlets** usually 6 in a whorl; once or twice divided; those toward the center of the axis frequently elongated, even exceeding the axis in length. **Dactyls of sterile branchlets** 2–3, terminated by a crown of 3 elongate, 2-celled terminals including the ultimate mucro (about 200 x 116 μ), and a basal cell (610 x 290 μ). **Fertile branchlets** 6 (?) in a whorl, once divided, into 2–3, 2–celled dactyls, contracted into dense terminal heads, with additional branchlets forming within the whorl. **Dactyls of fertile branchlets** 2–3, 2–celled, including a terminal, sharp-pointed and tapering mucro (early deciduous). **Gametangia** aggregated and at same node. **Oogonia** aggregate, usually 3 together, apparently on one side of the node; **coronula** evanescent. **Oospore** nearly round, 280 μ long, 260 μ broad; **striations** of 5 ridges; **membrane** minutely granular. **Antheridia** about 520 μ in diameter, somewhat stipitate, persisting after subtending dactyls have excised.[65]

ILLUSTRATIONS: Allen (1894: pl. 17).

EXSICCATAE: None issued. Specimen: [*C. G.*] *Pringle*, Oct. 5, 1888. Sierra Madre of W. Chihuahua, Mexico (NY).

DISTRIBUTION FOR NORTH AMERICA: **Mexico:** — Chihuahua, Allen (1894: 17) for Arroyo Ancho, Sierra Madre of W. Chihuahua (TYPE LOCALITY).

[63] Braun (1883: 91).

[64] Allen suggests that the swollen nodes relate to the manner in which segments of branchlets drop off very early, so that the mucros can be found only on the youngest leaflets, and branchlets drop from axial nodes leaving rings of thickened nodal cells. These rings are the basis for the name *annularis*.

[65] Allen (1894: 16).

This species was described by Allen (1894: 16) based on the specimen cited as "collected by *Mr. Pringle*, in a 'cold pool, Arroyo Ancho, Sierra Madre, of W. Chihuahua, October 8, 1888,' in Mexico."

24. Nitella Morongii Allen

Nitella Morongii Allen, Bull. Torrey Bot. Club **14**: 214. 1887.

LITERATURE FOR NORTH AMERICA:

Nitella Morongii: Allen, l.c., p. 214, pl. 75. — Char. Amer. **1**: 7, 44. 1888. — Owen, Pl. Nantucket p. 74. 1888. — Nordstedt, Lunds Univ. Årsskr. **25**(4): 9. 1889. — Allen, Char. Amer. **2**(2): 9 (key), 15, pl. 16. 1894. — Bull. Torrey Bot. Club **25**: 73. 1898.

Plant monoecious, 8–15 cm. high. **Branchlets** about 6 in a whorl. **Sterile branchlets** 1–2 times divided. **Fertile branchlets** 1–2 (rarely 3) times divided, condensed into dense heads 6–8 mm. in diameter; branchlets very short. **Dactyls of sterile branchlets** 1 (–2) –celled and apparently deciduous. **Dactyls of fertile branchlets** (3–) 4, 2–celled; the penultimate cell not inflated; the ultimate cell a mucro 45 μ broad at the base, 140 μ long, tapering to a sharp point. **Gametangia** solitary, on the last branchlet node, not (?) enveloped in mucus. **Oogonia** solitary; **coronula** persistent. **Oospores** 250–260 μ long by 240–245 μ wide; **striations** of 5 prominent ridges; **membrane** minutely granulate or grumous, like felt with knotty fibers. **Antheridia** 170 μ in diameter.[66]

ILLUSTRATIONS: Allen (1894: pl. 16).

EXSICCATAE: Phyc. Boreali-Amer., Fasc. XXVIII, *1382*. Issued as duplicates from the herbarium of T. F. Allen apparently posthumously by the New York Botanical Garden: *F. S. Collins*, Aug. 23, 1896. In a small pool near Siasconset, Nantucket, Mass. (from the original station). Duplicates were also issued under the title "Characeae Americanae Exsiccatae," apparently in the same manner; i.e., posthumously: *T. Morong*. Nantucket, Mass.

DISTRIBUTION FOR NORTH AMERICA: **United States:** — Massachusetts, Allen (1887: 214; 1894: 15), Owen (1888: 74) for Nantucket (TYPE LOCALITY).

This species was described by Allen (1887: 214) from the only known specimens cited as ". . . gathered by the Rev. Thos. Morong, on the Island of Nantucket, in a very muddy pool, July 21st, 1887."

Zaneveld (1940: 70) suggested that *N. Morongii* Allen, along with *N. brachyteles* Braun, *N. sublucens* Allen, and *N. axillaris* Braun, should be united as a variety or a synonym of *N. translucens* (Pers.) Agardh.

25. Nitella axillaris Braun

Nitella axillaris Braun, Monatsber. k. Akad. Wiss. Berlin (1858): 356. 1859.

LITERATURE FOR NORTH AMERICA:

Nitella axillaris: Braun, Abh. k. Akad. Wiss. Berlin (1882): 48. 1883. — Allen, Char. Amer. **1**: 44 (key). 1888. — ibid. **2**(2): 9 (key), 15, pl. 15. 1894. — Bull. Torrey Bot. Club **25**: 73. 1898. — Daily, Butler Univ. Bot. St. **6**: 154. 1944.

Nitella translucens: Woods, Fl. Nebraska p. 124, pl. 29. 1894. (= *N. axillaris*, fide Daily).

[66] Allen (1894: 15).

Plant monoecious, 25–45 cm. high, transparent, shiny. Stem stout. Internodes 1½–4 times the length of the branchlets. **Sterile branchlets** (4–) 6 in a whorl, about 2 mm. long, once furcate; primary rays nearly as long as the entire branchlets; secondary rays (2–) 3 (–4), 2–celled, much abbreviated; basal cell about 75 μ long by 50 μ wide; the ultimate cell about 75μ long by 30 μ wide, conical, acuminate. **Fertile branchlets** 4–6 in a whorl, usually 1–2 times furcate; secondary rays 1–3, tertiary rays, if any, (1–) 3 (–4), 2–celled; contracted into dense heads about 3 cm. [mm. ?] in diameter, of which 1–5 are produced in the axils of the whorls of sterile branchlets. **Dactyls** (1–) 3 (–4), 2–celled; basal cell of sterile branchlets tapering into the conical, acuminate ultimate cell; basal dactyl cell of the fertile branchlets rounded at the apex, therefore being proportionally much wider than the more allantoid ultimate cell. The penultimate cells of the fertile dactyls are much larger than in the sterile dactyls. **Gametangia** sessile, aggregated at all free nodes though frequently lacking on the ultimate node; not enveloped in mucus. **Oogonia** solitary or geminate, seldom triple, lateral; enveloping cells generally showing 7 convolutions; **coronula** about 45 μ high, 30 μ wide at the base; persistent. **Oospores** light brown, 270–300 μ long x 240–300 μ wide; **striations** of 5–7 ridges; **membrane** reticulate. **Antheridia** 220–270 (–300) μ in diameter.[67]

ILLUSTRATIONS: Braun (1883: pl. 1, fig. 35–38), reprinted in Allen (1894: pl. 15), Woods (1894: pl. 29).

EXSICCATAE: Duplicates have been widely distributed by the New York Botanical Garden: *E. J. Alexander*, Feb. 1935, in an aquarium, New York Botanical Garden, Bronx Park, N. Y. (NY), det. G. O. Allen. [Original source not known ?].

DISTRIBUTION FOR NORTH AMERICA: **Mexico**: — Orizaba, Braun (1883: 48); **United States**: — Nebraska, Woods (1894: 124), Daily (1944: 154).

TYPE LOCALITY: Venezuela, near Caracas.

This species was described by Braun (1859: 356) based on the specimen cited as "In stagnis prope Caracas (im See von Valle) Mart. 1854 legit. J. Gollmer (herb. A. Br.)."

Zaneveld (1940: 70) pointed out that Braun separated this species from *N. translucens* (Pers.) Agardh, on the basis of the length of the oospores and the fertile heads which occur only in the axils and never terminally as in *N. translucens*. Zaneveld expressed his doubt as to the necessity of this distinct species, and proposed to unite *N. axillaris* Braun, *N. Morongii* Allen, *N. sublucens* Allen, and *N. brachyteles* Braun as entities of the original *N. translucens*.

26. Nitella oligospira Braun

Nitella oligospira Braun, Monatsber. k. Akad. Wiss. Berlin (1858): 357. 1859.

LITERATURE FOR NORTH AMERICA:

Nitella oligospira: Allen, Char. Amer. **1**: 47 (key). 1888. — (cf. var. *Wrightii*).

[67] Zaneveld (1940: 69), supplemented from Daily (1944: 154)

Plant monoecious, grayish to bright green, lax, about 25 cm. high. Stem rather slender to moderately stout. Internodes 0.5–3 times the length of the branchlets. **Sterile branchlets** 6–7 in a whorl, about 1.5 cm. long, rigid and spreading, (2–) 3 (–4) times furcate; primary rays ½–⅓ as long as the entire branchlet; secondary rays 4–5; tertiary rays 2–3, of which 1–2 are again forked with 1–3 quaternary rays. **Fertile branchlets** 5–7 in a whorl, tufted, 2.5–3 cm. long, 4 (–5) times furcate; primary rays ⅓ the length of the branchlets; secondary rays 5–7; tertiary rays 3–4, most of them again furcate into 2–3 quaternary rays; sometimes 1–2 of these give rise to 1–2 quinary rays. **Dactyls** 1–3, 2–celled, varying in length, some are short and others very long; lower cell cylindrical but variable in length, rounded or truncate at the apex; ultimate cell conical, acuminate. **Gametangia** sessile, at all free branchlet nodes except occasionally the ultimate nodes; not enveloped in mucus. **Oogonia** solitary, lateral, 384–560 μ long, 365–460 μ wide; enveloping cells showing 7–8 convolutions; **coronula** 30–40 μ high, 27–38 μ wide at base, persistent, the cells of both tiers equal in length. **Oospores** light brown, 260–400 μ long, 215–365 μ wide; **striations** of 6–7 broad ridges; **membrane** reticulate. **Antheridia** terminal, 208–310 μ in diameter.[68]

ILLUSTRATIONS: (cf. varieties)

EXSICCATAE: (cf. varieties)

DISTRIBUTION FOR NORTH AMERICA: (cf. varieties)

TYPE LOCALITY: Venezuela, near Caracas.

This species has been accepted in the literature since its first publication by Braun (1859: 357) based on the specimen cited as "In stagnis prope Caracas (Lagune von Valle) Mart. 1856 l. J. Gollmer."

Nitella oligospira var. **Salzmanniana** Braun (?) var. dub.

Nitella oligospira var. *Salzmanniana* Braun, Abh. k. Akad. Wiss. Berlin (1882): 70 (sine descr.), 206 (as var.) in explanation of plates, pl. 2, fig. 50–52. 1883.

LITERATURE FOR NORTH AMERICA:

Nitella oligospira var. *Salzmanniana*: Braun, l.c.

To date, the writer has been unable to locate any published data or specimens upon which a description could be based.

ILLUSTRATIONS: Braun (1883: pl. 2, fig. 50–52).

EXSICCATAE: (non vidi).

DISTRIBUTION FOR NORTH AMERICA: (?). (cf. text).

TYPE LOCALITY: ?

The writer has been unable to locate any literature on this variety other than Braun's (1883) notes and figures. Since he states that the specimen was collected by Gollmer, it is suspected that the material was collected in South America. However, the information is discussed under the heading

[68] Zaneveld (1940: 83).

for North America. For this reason, the variety is entered in this paper with reservations.

The name *Nitella oligospira* (var.) *Salzmanniana* appeared in Braun's (1883: 70) works without description, but was accompanied by detailed figures of the dactyls. In accordance with Art. 44 of the "International Rules of Botanical Nomenclature," prior to January 1, 1908, a name published with figures accompanied by analyses, constitutes a validly published name. The writer strongly doubts that the information can be construed to form a suitable analysis, and awaits the location of the original specimen.

Nitella oligospira var. **Wrightii** Braun

Nitella oligospira var. *Wrightii* Braun, Abh. k. Akad. Wiss. Berlin (1882): 70. 1883.

LITERATURE FOR NORTH AMERICA:

Nitella (*Tolypella*) *intricata*: Halsted (pro parte), Proc. Boston Soc. Nat. Hist. **20**: 178. 1879, and Robinson, Fl. Essex Co., Mass. p. 147. 1880. (= *N. oligospira* var. *Wrightii*, fide Braun (1883: 70); cf. also *N. microcarpa* subsp. *megacarpa*).

Nitella oligospira var. *Wrightii*: Braun, l.c. — Allen, Char. Amer. **2**(3): 20. 1896.

This variety differs from the species especially in the larger size of the antheridia, 300–310 μ in diameter.[69]

ILLUSTRATIONS: Braun (1883: pl. 2, fig. 53–55).

EXSICCATAE: Phyc. Boreali-Amer., Fasc. E, *CIII*. Issued as duplicates from the herbarium of T. F. Allen apparently posthumously by the New York Botanical Garden: *P. Allen*, Aug. 1882. Saranac Lake, N. Y. (NY).

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Texas, Halsted (1879: 178), Braun (1883: 70) and Allen (1896: 20) for West Texas and near New Braunfels (TYPE LOCALITIES).

This variety was described by Braun (1883: 70) based on specimens cited as "In the Leona, running water, West Texas (Mexican Boundary Juli 1851 *Ch. Wright.*)" and "In the Comale (Bach bei Neubraunfels nach Engelmann) clear running water, Texas (coll. 1850 *Ch. Wright*)." Apparently no further studies for this variety have been reported in the literature.

27. Nitella microcarpa Braun

Nitella microcarpa Braun, Monatsber. k. Akad. Wiss. Berlin (1858): 357. 1859.

LITERATURE FOR NORTH AMERICA:

Nitella microcarpa: Braun, Abh. k. Akad. Wiss. Berlin (1882): 71, pl. 2, fig. 56–59. 1883. — Allen *in* Britton, Final Rep. State Geol. (N. Jersey) **2**: 356. 1889. — (cf. also under varieties and subspecies).

Plant monoecious, dark brownish-green, up to 25 cm. high. Stem moderately stout to slender, 500–1100 μ in diameter. Upper internodes ½–1 times as long as the branchlets. Lower internodes usually somewhat longer than the upper internodes. **Sterile branchlets** 6 in a whorl, up to 4 cm.

[69] Braun (1883: 70).

long, 2–3 times furcate; primary rays 4–6; tertiary 2–4, of which usually 1–3 are again furcate into 1–3 quaternary rays. **Fertile branchlets** 6 in a whorl, 1.5–2 cm. long, 3–4 times furcate, much condensed; primary rays ⅓–½ the length of the entire branchlet; secondary rays 4–6; tertiary rays 3–5, of which 1–2 are again forked into 2–3 quaternary rays; quinary rays, if any, 1–3. **Dactyls** 1–3, usually 2-celled, but often 3-celled, occurring especially in the sterile branchlets; penultimate cell varying up to 1000 μ, 55–120 μ wide; ultimate cell conical, 60–150 μ long, 20–90 μ wide at base. **Gametangia** frequently together at all nodes of fertile branchlets except the ultimate node which is generally sterile; not enveloped in mucus. **Oogonia** sessile, lateral, frequently 2–4 (–more) together around one antheridium; 250–530 μ long, 210–415 μ wide; enveloping cells showing 7–8 convolutions; **coronula** 30–80 μ high, 45–100 μ wide at base, persistent, both tiers of cells equal in length. **Oospores** golden-brown, 180–450 μ long, 225–450 μ wide; **striations** of 6 sharp ridges; **membrane** reticulate. **Antheridia** sessile, solitary, terminal, 180–290 (–400 in subspecies *megacarpa*) μ in diameter.[70]

ILLUSTRATIONS: Braun (1883: pl. 2, fig. 56–59).

EXSICCATAE: (cf. under subspecies and varieties)

DISTRIBUTION FOR NORTH AMERICA: **Canada**: — Quebec, Montreal, Braun (1883: 71). (cf. also under varieties)

TYPE LOCALITY: Paramaribo, Dutch Guiana, and "near Panama."

The name *Nitella microcarpa* was first employed by Braun (1859: 357) in the description based on the specimen cited as "Circa Paramaribo Guyanae hollandicae 1827 detexit Weigelt; prope Panama 1846 eandem legit Duchassaing (herb. Kunze, Hooker, Lenormand, A. Br. etc.)."

The group of names which Zaneveld (1940: 101) chose to assemble as synonyms under this species includes a number of very confusing forms, such as *N. Glaziovii*, *N. microglochin*, *N. polyglochin*, and a number of subspecific forms. These are particularly pertinent to a study of the species of North America, which has a rather good representation of such forms. These are treated in greater detail under each variety or subspecies below.

Nitella microcarpa var. **Drummondii** Braun

Nitella microcarpa var. *Drummondii* Braun, Abh. k. Akad. Wiss. Berlin (1882): 72. 1883.

LITERATURE FOR NORTH AMERICA:

Nitella microcarpa var. *Drummondii*: Braun, l.c., p. 72, pl. 2, fig. 58, 59.

This variety is characterized by the extreme length of the primary branchlet rays which exceed the rest of the branchlet in length; by the dactyls which, though thick and bushy as in the species, are shorter than in the species; by the secondary rays which are frequently 6 and give the appearance of a branchlet whorl formed at the first branchlet node;

[70] Zaneveld (1940: 101).

by the ultimate cell of the dactyls which is equal in length to the penultimate cell instead of exceeding it as in the species; by the oogonia which are 2–4 together and smaller than in the species (250–260 μ long, 210 μ wide).[71]

ILLUSTRATIONS: Braun (1883: pl. 2, fig. 58, 59).

EXSICCATAE: None. Specimen: (non vidi).

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Louisiana, Braun (1883: 72) for New Orleans (TYPE LOCALITY).

This variety was described by Braun (1883: 72) based on the specimen cited as "Nord-Amerika. New-Orleans (Drummond; N. J. Winch's foreign herbarium in Linnean Society, London)."

Nitella microcarpa var. **Glaziovii** (Zeller) Zaneveld

Nitella Glaziovii Zeller, Symb. ad Fl. Brasiliae Centr. Cognosc. **22**: 428. 1876.
Nitella microcarpa var. *Glaziovii* Zaneveld, Blumea **4**: 104. 1940.

LITERATURE FOR NORTH AMERICA:

Nitella Glaziovii: Allen *in* Mohr, Contrib. U. S. Nat. Herb. **6**: 147. 1901.
Nitella microcarpa (subsp. or var.) *Glaziovii*: Allen, Char. Amer. **1**: 47 (key). 1888. — Bull. Torrey Bot. Club **21**: 525. 1894.

Plant stout. Stem up to 1100 μ in diameter. Dactyls varying much in length, frequently one or two dactyls much longer than the others; sometimes all much elongated or abbreviated; *2* (–3)-celled; penultimate cell up to 1000 μ long, and 120 μ in diameter; ultimate cell conical, up to 150 μ long, and 90 μ in diameter. Gametangia occurring at the ultimate branchlet node only if one or more of the dactyls are elongated. Oogonia 415–475 μ long (including the coronula), 300–325 μ wide. Oospores 240–280 μ long, 220–250 μ wide; striations (no data given); membrane (no data given). Antheridia (no data given).[72]

ILLUSTRATIONS: None.

EXSICCATAE: Issued as duplicates from the herbarium of T. F. Allen apparently posthumously by the New York Botanical Garden: *J. W. Blankinship*. Springfield, Missouri. Other specimens were also issued with the label title "Characeae Americanae Exsiccatae."

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Alabama, Allen *in* Mohr (1901: 147).

TYPE LOCALITY: Rio de Janeiro, Brazil.

This species was first described by Zeller (1876: 428) as *Nitella Glaziovii* based on the specimen cited as "Gavia ad Rio de Janeiro. (5449). (Inter Characeas etiam commemoranda est sec. Kützing sp. alg. p. 518 'Nitella clavata Kg.' quam in Brasilia collegit Sellow)."

Nordstedt *in* Braun (1883: 72) reduced the species to the subspecies *N. microcarpa* subsp. *Glaziovii* (Zeller) Nordst., and emended the de-

[71] Braun (1883: 72).
[72] Zaneveld (1940: 104).

scription. Zaneveld (1940: 104) reduced it to the varietal status as it appears in the present work.

Nitella microcarpa subsp. **megacarpa** (Allen) Nordstedt

Nitella megacarpa Allen, Char. Amer. Exsicc. *3*. 1880. (descr.).

? *Nitella polyglochin* subsp. *megacarpa* Allen, l.c. in descr. (nom. ambig.).

Nitella microcarpa subsp. *megacarpa* Nordstedt *apud* Braun, Abh. k. Akad. Wiss. Berlin (1882): 73. 1883.

LITERATURE FOR NORTH AMERICA:

Nitella intricata: Halsted, Proc. Boston Soc. Nat. Hist. **20:** 178. 1879, and Robinson, Fl. Essex Co., Mass. p. 147. 1880. (in part, fide Nordst. *in* Braun (1883: 73)); (cf. also *N. oligospira* var. *Wrightii*).

? *Nitella macrocarpa*: Allen *in* Britton, Final Rep. State Geol. (N. Jersey) **2**: 356. 1889.

Nitella megacarpa: Allen, l.c. — Bull. Nat. Hist. Soc. New Brunswick **1**[2]: 15 (fossil). 1883. — Char. Amer. **1**: 6, 28 (fig. 36). 1888. — Nordstedt, Lunds Univ. Årsskr. **25**(4): 12. 1889.

? *Nitella microcarpa*: Allen *in* Britton, Final Rep. State Geol. (N. Jersey) **2**: 356. 1889.

Nitella microcarpa subsp. *megacarpa*: Nordstedt *in* Braun, l.c. — Allen, Char. Amer. **1**: 47 (key). 1888. — Bull. Torrey Bot. Club **21**: 525. 1894.

Nitella microcarpa var. *megacarpa*: Groves, H. & J., *in* Urban, Symb. Antill. **7**(1): 37. 1911. — Zaneveld, Blumea **4**: 102. 1940.

Nitella polyglochin: Pieters, Bull. U. S. Fish Comm. (1901): 78. 1901. (fide Wood, Ohio Journ. Sci. **47**: 248. 1947).

Nitella polyglochin var. *megacarpa*: Allen, l.c. — Char. Amer. **1**: 8. 1888.

Nitella polyglochin subsp. *megacarpa*: Dame and Collins, Fl. Middlesex Co., Mass. p. 151. 1888.

? *Nitella polyglochin* var. *microcarpa*: Allen, Bull. Torrey Bot. Club **2**(3): 9. 1871.

This subspecies differs from the species primarily in the greatly enlarged sex organs: oospores 440–530 μ long, antheridia about 400 μ in diameter.[73]

ILLUSTRATIONS: Wood (1947: pl. 1, fig. 4a–e).

EXSICCATAE: Char. Amer. Exsicc. *3*; Phyc. Boreali-Amer., Fasc. E, *CII*, Fasc. XXXII, *1588*. Issued as duplicates from the herbarium of T. F. Allen apparently posthumously by the New York Botanical Garden: *Robinson*, Aug. 1880. Boxford, Mass.

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Connecticut, Allen (1880: No. *3*, exsicc.) for "Bantam Lake" (TYPE LOCALITY); — Massachusetts, Halsted (1879: 178) as *N. intricata*, Nordstedt *in* Braun (1883: 73), Dame & Collins (1888: 151); — New Jersey, Allen *in* Britton (1889: 356).

Allen's treatment of this entity is very confusing throughout his writings, because he failed to decide upon what disposition to make of the plant. His original description (1880: No. *3*, exsicc.), and apparently the only description that exists for the subspecies, appears on the label of his exsiccata specimen No. *3*, with the collection data "Habitat: 'Bantam Lake,' Litchfield, Conn., (T.F.A.); Boxford, Mass., (John Robinson). Coll.: T. F. Allen, August, 1880." The label states clearly that the name *N. megacarpa* Allen is being described; but in the diagnosis the statement "Sub-species *N. polyglochin*, A. Br. sensu latiore." is very ambiguous, as one is left

[73] Allen, Char. Amer. Exsicc. *3*.

undecided whether Allen meant the new form to be a species or a subspecies. If Allen meant *N. polyglochin* Braun *sensu latiore* to indicate a subgeneric section of *Nitella* as he employed it later (1888: 47), *N. polyglochin* Braun, in its broadest sense (= brachydactylae), then *N. megacarpa* could be construed to have been intended as a full species. In later writings, Allen referred to this plant under *N. microcarpa*, *N. megacarpa*, *N. polyglochin*, and various subspecific forms of these species.

Zaneveld (1940: 103) included *N. polyglochin* Braun *sens. lat.* under his new combination *N. microcarpa* var. *microglochin*; and it appears probable that this is a more consistent disposition. Further monographic study of the American forms is greatly needed in this group.

28. Nitella transilis Allen

Nitella tenuissima forma *longifolia elongata* Allen, Char. Amer. Exsicc. *31*. 1888. (nom. nud.).
Nitella tenuissima forma *longifolia* Allen, Char. Amer. **1**: 7. 1888. (nom. nud.).
Nitella transilis Allen, Char. Amer. **2**(3): 24. 1896.

LITERATURE FOR NORTH AMERICA:
Nitella tenuissima forma *longifolia*: Allen, l.c.
Nitella tenuissima var. *longifolia*: Allen, l.c.
Nitella transilis: Allen, l.c. — Bull. Torrey Bot. Club **25**: 77. 1898. — Burnham and Latham, Torreya **23**: 4. 1923. — Grier, Amer. Midl. Nat. **9**: 60. 1924–5.

Plant monoecious, 5–10 cm. high, rarely branched. Stem slender. **Branchlets** 5–6 in a whorl, 3–4 times furcate; secondary rays 6. **Dactyls** 3–4, 2–celled, the ultimate cell a mucro 60–70 μ long. **Gametangia** isolated at the second (rarely the third) node of the branchlets. **Oogonia** isolated. **Oospores** 272–285 μ long, 245–265 μ wide; **striations** showing 7–8 prominent ridges; **membrane** reticulate to smooth. **Antheridia** (dimensions not given).[75]

ILLUSTRATIONS: Allen (1896: pl. 23).

EXSICCATAE: Char. Amer. Exsicc. *31*. sub. nom. *N. tenuissima* f. *longifolia elongata*. Issued as duplicates from the herbarium of T. F. Allen apparently posthumously by the New York Botanical Garden: *T. F. Allen*. Sparta, New Jersey.

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Massachusetts, Allen (1896: 24); — New Jersey, Allen (1896: 24); — New York, Burnham & Latham (1923: 4), Grier (1924–5: 60); — Rhode Island, Allen (1896: 24).

TYPE LOCALITY: (?).

This species was described by Allen (1896: 24) based on the exsiccata specimen No. *31* of Characeae Americanae Exsiccatae. Allen (1888: 7) referred to this specimen as f. *longfolia*, and (1896: 24) as var. *longifolia*. Apparently no monographic works have treated this species since it was described.

29. Nitella tenuissima (Desv.) Kützing

Chara tenuissima Desvaux, Journ. de Bot. **2**: 313. 1809.
Nitella tenuissima Kützing, Phyc. Gen. p. 319. 1843.

[75] Allen (1896: 24).

LITERATURE FOR NORTH AMERICA:

Chara tenuissima var. *americana*: Braun *in* Engelmann and Gray, Boston Journ. Nat. Hist. **5**: 264. 1845. (nom. nud.).

Nitella tenuissima: Wallman, K. Vets.-Akad. Handl. (1852): 246. 1854. — Allen, Bull. Torrey Bot. Club **2**(3): 9. 1871. — Halsted, Proc. Boston Soc. Nat. Hist. **20**: 177. 1879. — Allen, Char. Amer. **2**: 6, 13, pl. 6. 1880. — Braun, Abh. k. Akad. Wiss. Berlin (1882): 62. 1883. — Dame and Collins, Fl. Middlesex Co., Mass. p. 151. 1888. — Allen, Char. Amer. **1**: 46 (key). 1888. — *in* Bennett, Pl. Rhode I. p. 58. 1888. — *in* Britton, Final Rep. State Geol. (N. Jersey) **2**: 356. 1889. — Nordstedt, Lunds Univ. Årsskr. **25**(4): 10. 1889. — Allen, Char. Amer. **2**(3): 19 (key), 24, pl. 22. 1896. — Groves, H. & J., *in* Urban, Symb. Antill. **7**: 34. 1911. — Taylor, Rhodora **23**: 67. 1921.

Nitella tenuissima var. *americana*: Allen, Char. Amer. **1**: 6 (descr.). 1880 (= ? *N. tenuissima*, cf. text).

Nitella batrachosperma: Pieters, Bull. U. S. Fish Comm. (1901): 78. 1901. (= *N. tenuissima*, fide Wood [76]).

Plant monoecious. **Branchlets** 6 in a whorl, 3–4 times divided; primary rays 1/3–2/5 the entire length of the branchlet. **Dactyls** 3–4, regularly 2-celled; the penultimate cell tapering toward the apical cell so as to be nearly equal in diameter to the base of the mucro; mucro elongate, and narrowly acuminate. **Gametangia** occurring frequently together, at the second and third branchlet nodes (not at the first). **Oogonia** solitary, 400 μ long by 260 μ wide; **coronula** persistent. **Oospores** conspicuously flattened, about 200–250 μ long, 175–200 μ wide, and 100–130 μ thick; **striations** of 7–8, fine, but well-defined, low ridges; **membrane** strongly reticulate with beaded reticulation threads. **Antheridia** about 175 μ in diameter.[77]

ILLUSTRATIONS: Groves & Bullock-Webster (1920: pl. 5, fig. 3–5; pl. 14), Allen (1896: pl. 22).

EXSICCATAE: Char. Amer. Exsicc. *1*; Phyc. Boreali-Amer., Fasc. XVII, *821*, Fasc. XXXI, *1534*. Issued as duplicates from the herbarium of T. F. Allen apparently posthumously by the New York Botanical Garden: *P. V. LeRoy*, Peeksville, New York; *Francis Wolle*, New Jersey; *J. W. Blankinship*, June 1, 1893. In stagnant pool near Uncle Sam Mountain, Lake Co., Calif.

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Florida, Allen (1880: 6); — Maine, Taylor (1921: 67); — Massachusetts, Wallman (1854: 246), Allen (1880: 13), Braun (1883: 62), Dame and Collins (1888: 151), Nordstedt (1889: 10); — Michigan, Halsted (1879: 178), Allen (1880: 13), Braun (1883: 62); — New Jersey, Allen (1880: 6), Allen *in* Britton (1889: 356); — New York, Allen (1880: 13; 1896: 24); — Ohio, Pieters (1901: 78); — Rhode Island, Halsted (1879: 178), Allen (1880: 13), Allen *in* Bennett (1888: 58).

TYPE LOCALITY: Europe.

The first occurrence of the name *Chara tenuissima* in the literature was the description by Desvaux (1809: 313) based on the specimen cited (Desvaux, 1810: 136, cf. below) as collected by "M. Desvaux. . . . pendant le mois de Juin, dans les ruisseaux d'une fontaine aux environs de Poitier." However, as this reference occurred in a rather obscure jour-

[76] Wood, Ohio Journ. Sci. **47**: 246. 1947.

[77] Groves & Bullock-Webster (1920: 121).

nal, most students consider the first publication as by Desvaux (1810: 136) *in* Loiseleur-Deslongchamps, Notice sur les Plantes à ajouter à la Flore de France.

In 1805,[78] DeCandolle (1805: 247) described *Chara hyalina*. Desvaux (1818: 45) reported that DeCandolle's plant was identical to his *C. tenuissima*, and, as he thought that DeCandolle's publication was of a date later than his work of 1809, stated that DeCandolle's name was invalid. If Desvaux had been right in stating that DeCandolle's plant was identical to his, he would still have been wrong in assuming his name had priority. It remained for Braun (1835: 54) to actually compare the plants of both workers, and decide that DeCandolle's material included both *C. tenuissima* Desv. and *C. hyalina* DC. Thus, both *C. hyalina* DC. pro parte and *C. tenuissima* Desv. proved to be valid and good species.

Braun (1845: 264) listed *C. tenuissima* var. *americana* for the United States, but without description. Allen (1880: 6) described *Nitella tenuissima* var. *americana* based on Braun's record. His description was quoted as follows: "Whorls less densely glomerate, but more approximate than in the European form." However, as both men dropped this usage in later works, it is assumed that both authors concluded that the distinctions between the American and European forms of *N. tenuissima* were insignificant. This name did not appear either in Braun's "Fragmente einer Monographie der Characeen" (1883) or in Allen's "Characeae of America" (1892–1896). The writer considers the variety as doubtful.

Nitella tenuissima var. **compacta** Braun

Nitella tenuissima var. *compacta* Braun, Abh. k. Akad. Wiss. Berlin (1882): 62. 1883.

LITERATURE FOR NORTH AMERICA:

Nitella tenuissima var. *compacta*: Braun, l.c. — Allen, Char. Amer. **2**(3): 25. 1896.

This variety is distinguished by its minute size, 4–5 cm. high; and thick, compact branchlets.

ILLUSTRATIONS: Groves & Bullock-Webster (1920: pl. 14, fig. 2), Allen (1896: pl. 22, fig. 2).

EXSICCATAE: (Non vidi).

DISTRIBUTION FOR NORTH AMERICA: **United States**: — California[79] (?), Braun (1883: 62); — New Mexico, Braun (1883: 62) (TYPE LOCALITY ?); — Texas, Braun (1883: 62), Allen (1896: 25).

This variety was described by Braun (1883: 62) from material collected in New Mexico, Texas, and California, cited as "C. Wright, Coll. N. Mex. 1851 no. 86 (comm. Engelmann 1853). Dieselbe von Lindheimer in Texas (in clear springs and creeks near Millcreek west of Brazos)

[78] DeCandolle *in* Lamark, Flore Francaise, **6** (1805). Certain editions were mistakenly dated 1815 instead of the correct 1805 (cf. Journ. Bot. p. 431. 1896).

[79] Braun's original text gave "Monterey, in Nord-Mexico" to which Nordstedt inserted "California."

gesammelt 1844 und von Engelmann mitgetheilt. . . . .Monterey in Nord-Mexico (California) Dr. Gregg 1847; von Engelmann erhalten Jan. 1849."

Apparently no further monographic work has treated this form, though Groves and Bullock-Webster (1920: pl. 14, fig. 2) illustrate the same entity but do not employ the formal Latin name for their "compact form."

30. Nitella mucronata (Braun) Miquel

(Non) *Chara furcata* Roxburgh apud Bruzelius, Obs. in Genus Charae p. 22. 1824. (= *N. furcata* (Roxb. ap. Bruz.) Agardh, Syst. Alg. p. 124. 1824).

Chara furcata Barbieri ex Amici, Descriz. alc. sp. nuove, p. 14. 1827.

Chara mucronata Braun, Ann. Sci. Nat. 1^2: 351. 1834.

Nitella mucronata Miquel *in* van Hall, Fl. Belg. Septentrionalis **2**: 428. 1840.

Nitella mucronata Braun, Neue Denkschr. schweiz. Gesell. Naturw. **10**(3): 9. 1847.

LITERATURE FOR NORTH AMERICA:

Nitella mucronata: Kützing, Spec. Alg. p. 514. 1849. — Wallman, K. Vets.-Akad. Handl. (1852): 253. 1854. — Allen, Bull. Torrey Bot. Club **2**(3): 10. 1871. — Braun, Abh. k. Akad. Wiss. Berlin (1882): 51. 1883. — Allen, Char. Amer. **1**: 44 (key), 45 (key). 1888. — Owen, Pl. Nantucket, p. 74. 1888. — Webber, Trans. Acad. Sci. St. Louis **6**: 20. 1892. — Woods, Fl. Nebraska, p. 124. 1894. — Allen, Char. Amer. **2**(3): 19 (key), 20, 21, pl. 19. 1896. — (cf. also under subsp. *virgata*).

Plant monoecious, stout. Internodes 1–2 times the length of the branchlets. **Branchlets** 5–6 in a whorl, rather stout; sterile and fertile branchlets similar; 1–3 times divided; primary rays about 2/5–2/3 the length of the entire branchlet. **Dactyls** 2–3, 2 (–3)-celled; apical cell a short, conical mucro. **Gametangia** borne at each division of the branchlets. **Oogonia** solitary or geminate, 550–575 μ long, by about 400 μ wide; enveloping cells elongated in maturity (not swelling). **Oospores** dark brown, 300–350 μ long, 250–300 μ wide, 200 μ thick; **striations** of 6–7 thin, prominent ridges; **membrane** reticulate. **Antheridia** about 275 μ in diameter.[80]

ILLUSTRATIONS: Groves & Bullock-Webster (1920: pl. 5, pl. 12), Braun (1883: pl. 1, fig. 39–42, pl. 5, fig. 130), Woods (1894: pl. 28), Allen (1896: pl. 19).

EXSICCATAE: One series was issued as *N. mucronata* without designating the subspecific group as duplicates from the herbarium of T. F. Allen apparently posthumously by the New York Botanical Garden: *George E. Stone*. 1890. Worcester, Mass.

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Georgia, Allen (1896: 20); — Massachusetts, Allen (1896: 21); — Nebraska, Webber (1892: 20), Woods (1894: 124); — New Mexico, Allen (1896: 21); — Oregon, Allen (1896: 21); — Virginia, Braun (1883: 51).

TYPE LOCALITY: Europe.

This plant seems to have been first described by Amici (1827: 14) under the name *Chara furcata*. This is a later homonym of *C. furcata* Roxburgh *apud* Bruzelius (1824: 22) (= *Nitella furcata* (Roxb. *ap.* Bruz.) Agardh (1824: 124)). Braun (1834: 351) redescribed the same entity under the name *C. mucronata*. Most of the Characean students of

[80] Groves & Bullock-Webster (1920: 114).

the last century have credited either Braun (1847: 9) or Kützing (1845: 256) with having transferred the species to the genus *Nitella*. Groves and Bullock-Webster (1920: 113) seem to have been the first to recognize that this had been done some five years earlier by Miquel *in* van Hall (1840: 428).

Little difficulty was experienced with this species during the 19th century until, as a result of finer distinctions in species delimitation, Braun introduced the concept of "broad and strict sense" of the species (*sens. lat.* and *sens. strict.*). In Allen's (1888: 44) synopsis we find these two concepts employed in translating and modifying Nordstedt's synopsis which appeared in Braun's "Fragmente einer Monographie der Characeen" (1883: 8). In later works, Allen raised *N. mucronata, sens. lat.*, to a subgeneric section which he called the "Mucronatae," corresponding to other sections such as "Acuminatae" for *N. acuminata, sens. lat.*, Braun. Had Allen completed his monograph, the numerous existing subspecific entities of *N. mucronata, sens. lat.*, would doubtlessly have been raised to specific rank, and *N. mucronata, sens. strict.*, would then have been redefined as *N. mucronata* (*emend.*) of equal status with the new species. Allen did complete this for the "Acuminatae"; but, as the Arthrodactylae were not completed, the present classification for *N. mucronata* for North America is not at all consistent with that for the Anarthrodactylae. In the present paper, the writer has dropped Allen's treatment of both sections as far as is consistent with the objective of the problem, and has attempted to follow the latest monographs for both troublesome series.

Nitella mucronata subsp. **virgata** (Wallman) Braun

Nitella virgata Wallman, K. Vets.-Akad. Handl. (1852): 249. 1854.

Nitella mucronata subsp. *virgata* Braun, Monatsber. k. Akad. Wiss. Berlin (1867): 884. 1868.

LITERATURE FOR NORTH AMERICA:

Nitella mucronata subsp. *virgata*: Allen, Char. Amer. **1**: 45 (key). 1888. — Braun, Abh. k. Akad. Wiss. Berlin (1882): 51. 1883. (cf. under varieties).

Plant monoecious, about 20–40 cm. high, strong and erect, freely branching. Branchlets 6 in a whorl, 2–3 times divided. Dactyls (number not given), 2 (–3)-celled; the apical cell a slender mucro; penultimate cell not tapering toward the apex, being 3–8 times as broad as the base of the apical mucronate cell. Gametangia occurring at all branchlet nodes, not enveloped in mucus. Oogonia usually solitary, rarely aggregated. Oospores dark brown or nearly black, 260–360 μ long; striations of 7 rather prominent sharp ridges; membrane reticulate. Antheridia (cf. under varieties).[81]

ILLUSTRATIONS: (cf. under varieties).

EXSICCATAE: (Non vidi).

DISTRIBUTION FOR NORTH AMERICA: (cf. under species and varieties).

[81] Allen (1896: 20).

The name *virgata* first appeared in the literature for the genus *Nitella* in Wallman's (1854: 249) description of *N. virgata* based on the specimen cited as "Frankrike, Paris. Brongniart!" and "Ch. flexilis virgata *Al. Braun*! (in herb. *Ag.*)." Braun (1868: 884) was apparently the first writer to transfer *virgata* to a subspecies status.

As indicated under the discussion for *N. mucronata*, Allen's monographic work did not include this subspecies. For that reason, the literature for North America is very confused. This confusion stems largely from Braun (1883) or from Nordstedt's editing of Braun's manuscripts. Whichever is the case, the fact remains that the arrangement of subspecific forms which appears in this work is rather ambiguous. In Allen's works, this confusion is continued and magnified somewhat through the inconsistent usage of Braun's nomenclature.

Migula (1897: 153) reported his morphologic and culture investigations of the various forms of this species, and concluded that the only forms worth maintaining were subspecies *Wahlbergiana* (Wallman) Braun (1883: 51) and *virgata* (Wallman) Braun. Migula, in fact, seemed to indicate that these subspecies could well be maintained as separate species. Groves and Bullock-Webster (1920: 116) accepted Braun's treatment of these two as subspecies, and accepted var. *tenuior* Braun ex Rabenhorst (1863: 286) and var. *heteromorpha* Kützing (1845: 514). Zaneveld (1940: 97) followed much the same pattern, but accepted also var. *leiopyrena* Braun (1883: 54).

In the present work, the writer has followed Migula (1897: 157), Groves and Bullock-Webster (1920: 116), and Braun (1883: 51) in allocating all the forms of *N. mucronata* to the subspecies *N. mucronata* subspecies *virgata*.

Nitella mucronata subsp. **virgata** var. **leiopyrena** (Braun) Allen

Nitella mucronata subsp. *virgata* var. *pachygyra* forma *leiopyrena* Braun, Abh. k. Akad. Wiss. Berlin (1882): 54. 1883.

Nitella mucronata var. *leiopyrena* Allen, Char. Amer. **2**(3): 21. 1896.

LITERATURE FOR NORTH AMERICA:

Nitella mucronata subsp. *leiopyrena*: Allen, Char. Amer. **1**: 45 (key). 1888.

Nitella mucronata var. *leiopyrena*: Allen, Char. Amer. **2**(3): 21. 1896.

Nitella mucronata subsp. *virgata* var. *pachygyra* forma *leiopyrena*: Braun, l.c.

This variety is characterized especially by the smooth oospores without prominent striations.

ILLUSTRATIONS: Braun (1883: pl. 1, fig. 42).

EXSICCATAE: (Non vidi).

DISTRIBUTION FOR NORTH AMERICA: **Mexico**: — Sierra Madre, N. W. of Mexico [City ?], Braun (1883: 54); **United States**: — Virginia, Braun (1883: 54) for near Orange, Allen (1896: 21). Braun's two localities form the TYPE LOCALITIES.

The form was originally described by Braun (1883: 54) based on specimens cited as " 'Virginia ad paludem prope Orange' (leg. Carl Beyrich, von ihm als 'foliosa' bezeichnet). Sierra Madri N. W. of Mexico (leg. B. Seemann no. 1964; vidi in herb. Hooker 1853)."

Nitella mucronata subsp. **virgata** var. **pachygyra** Braun

Nitella mucronata subsp. *virgata* var. *pachygyra* Braun, Abh. k. Akad. Wiss. Berlin (1882): 53. 1883.

LITERATURE FOR NORTH AMERICA:

Nitella mucronata var. *pachygyra*: Allen, Char. Amer. **2**(3): 20. 1896.

Nitella mucronata subsp. *virgata* var. *pachygyra*: Braun, l.c.

This variety is characterized especially by the strongly prominent, thick striations of the oospores.

ILLUSTRATIONS: Braun (1883: pl. 1, fig. 39–41 ?).

EXSICCATAE: (Non vidi).

DISTRIBUTION FOR NORTH AMERICA: **Mexico**: — Mexican boundary [of Texas], Braun (1883: 53); **United States**: — New Mexico, Braun (1883: 53); — North Carolina, Braun (1883: 53); — Texas, Braun (1883: 53).

TYPE LOCALITY: New Mexico, Coppermine Creek, and Texas, Comale Creek.

The variety was described by Braun (1883: 53) based on specimens cited as "(C. Wright 1851–1852) com. Engelmann, sub lit. I. et L. (Coppermine Creek) 908 et N. (Leona; f. steril). In the Comale, Texas (Wright 1850) f. steril."

Nitella mucronata subsp. **virgata** var. **robustior** (Braun) Dame & Collins

Nitella mucronata α *robustior* Braun, Monatsber. k. Akad. Wiss. Berlin (1867): 882. 1868.

Nitella mucronata var. *robustior* (forma *longifurca*) Dame and Collins, Fl. Middlesex Co., Mass. p. 151. 1888.

LITERATURE FOR NORTH AMERICA:

Nitella mucronata subsp. *virgata* α *robustior*: Braun, Abh. k. Akad. Wiss. Berlin (1882): 52. 1883.

Nitella mucronata var. *robustior* (forma *longifurca*): Dame and Collins, l.c.

Nitella mucronata forma *robustior*: Allen, Char. Amer. **1**: 45 (key). 1888.

This variety is characterized by the very long forked lower branchlets.

ILLUSTRATIONS: None.

EXSICCATAE: (Non vidi).

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Massachusetts, Braun (1883: 52), Dame and Collins (1888: 151).

TYPE LOCALITY: Europe.

This variety was described by Braun (1868: 882) based upon the specimen in Rabenh. Char. Exsiccatae No. *30*, and *C. furcata* Barbieri ex Amici and *N. mucronata* Kütz., Phyc. Germ. p. 256, were cited as synonyms.

Nitella mucronata subsp. **virgata** var. **tenuior** Braun ex Crépin

Nitella mucronata β *tenuior* Braun ex Rabenhorst, Krypt.- Fl. Sachsen **1**: 286. 1863.[82]

Nitella mucronata var. *tenuior* Braun ex Crépin, Bull. Soc. Roy. Bot. Belg. **2**: 128. 1863.[82]

[82] The writer has been unable to establish proof of priority between these two publications.

Nitella mucronata subsp. *virgata* β *tenuior* Braun, Abh. k. Akad. Wiss. Berlin (1882): 53. 1883.

Nitella mucronata subsp. *virgata* var. *tenuior* Dame & Collins, Fl. Middlesex Co., Mass. p. 151. 1888.

LITERATURE FOR NORTH AMERICA:

Nitella mucronata var. *tenuior*: Allen, Char. Amer. **2**(3): 21. 1896.

Nitella mucronata forma *tenuior*: Allen, Char. Amer. **1**: 45 (key). 1888. — *in* Britton, Final Rep. State Geol. (N. Jersey) **2**: 356. 1889.

Nitella mucronata subsp. *virgata* var. *tenuior*: Dame & Collins, l.c.

Nitella mucronata subsp. *virgata* β *tenuior*: Braun, l.c.

This variety is characterized especially by very small size, stems 500–660 μ in diameter, sterile branchlets 150–300 μ or less in diameter; oospores 280–330 μ long.[83]

ILLUSTRATIONS: Braun (1883: pl. 1, fig. 39–41 [?]).

EXSICCATAE: (Non vidi).

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Massachusetts, Braun (1883: 53), Dame & Collins (1888: 151); — New Jersey, Allen *in* Britton (1889: 356); — Texas, Braun (1883: 53).

TYPE LOCALITY: Europe.

Braun's form *tenuior* of *N. mucronata* appears to have been described as a variety by Crépin and presumably as a form (*β tenuior*) by Rabenhorst, both of which appeared in 1863. Braun (1867: 2) [84] employed this designation as a subspecies, but later (1883: 53) reduced it again to a form. Filarszky (1926: 1307) [85] considers it a form. The writer reserves any expression of opinion, and for the present paper has entered the entity as a distinct variety until a revision of the species brings to light the status of this form.

31. Nitella minuta Allen [86]

Nitella minuta Allen, Char. Amer. Exsicc. *34*. 1888.[87] (descr.)

LITERATURE FOR NORTH AMERICA:

Nitella minuta: Allen, Char. Amer. **1**: 7, 39, 46 (key). 1888. — *in* Britton, Final Rep. State Geol. (N. Jersey) **2**: 356. 1889. — Nordstedt, Lunds Univ. Årsskr. **25**(4): 11. 1889. — Allen, Char. Amer. **2**(3): 19 (key), 26 (descr.), pl. 25. 1896.

[83] Braun (1868: 882).

[84] Conspectus Systematicus Characearum Europaearum, pp. 1–7. 1867.

[85] Folia Crypt. **10**: 1307–1316. 1926.

[86] In connection with *N. minuta* Allen, the facts concerning *N. Maxceana* should be brought to attention. Allen (1896: 27) reported a divergent form of *N. minuta* which appeared to be sufficiently distinct to be considered a new species. He described this plant on the insufficient material available, suggested the name *N. Maxceana*, and cited the specimen as collected by "Dr. Morong, Nantucket, Mass." He emphasized, however, that the material available was not adequate to establish a new species, and stated that he withheld his opinion until new material was obtained. The information concerning this sepcies is reassembled here: **Nitella Maxceana** Allen, spec. dub., Char. Amer. **2**(3): 27, footnote. 1896. Plant similar to *N. minuta* except for the larger, partially inflated stem, 220 μ in diameter; and the smaller, solitary oogonia, 156 μ long by 136 μ wide. ILLUSTRATIONS: None. EXSICCATAE: (Non vidi). DISTRIBUTION FOR NORTH AMERICA: **United States**: — Massachusetts, Nantucket, Allen (1896: 27) (TYPE LOCALITY).

[87] cf. Wood, Farlowia **3**: 328. 1948, for proposed dates for Allen's exsiccatae.

Plant monoecious, 2–6 cm. high. **Branchlets** (number not stated). **Sterile branchlets** filiform and spreading, undivided. **Fertile branchlets** twice divided. **Dactyls of fertile branchlets** 3, 2-celled, the apical cell a mucro about 120 μ long by 30 μ in diameter at the base. **Gametangia** solitary, fertile portions enveloped in mucus. **Oogonia** solitary (dimensions not stated). **Oospores** 350 μ long by 285 μ wide; **striations** of 6 thick and prominent ridges; **membrane** marked by roundish elevations or granules. **Antheridia** 200 μ in diameter.[88]

ILLUSTRATIONS: Allen (1896: pl. 25), Nordstedt (1889: pl. 1, fig. 11, for oospore membrane).

EXSICCATAE: Char. Amer. Exsicc. *34*. 1888.

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Massachusetts, Allen (1896: 27) as a questionable record; — New Jersey, Allen (1888: No. *34*, exsicc.) for Green Pond (TYPE LOCALITY).

The first description of this plant appeared on the label of the exsiccata specimen No. *34*. This specimen bears the data: "Habitat: Green Pond, New Jersey, Coll.: T. F. Allen, September, 1883." The plant was described in print later by Allen (1896: 26), wherein he omitted the earlier discussion concerning the antheridia, but added the information on the oospore membrane.

The species was confirmed by Nordstedt (1889: 11; 1918: [89] pl. 3).

32. Nitella Nordstedtiana Groves, H. & J.

(Non) *Chara batrachosperma* Thuillier, Fl. Envir. Paris, ed. 2, p. 473. 1799. (= *C. vulgaris* Linn. = *C. foetida* Braun (1847: 10)).

Chara batrachosperma Thuillier, accord. to Reichenbach, Iconogr. Bot. **8**: 794. 1830. — Fl. Germ. Excursoria **1**: 148. 1832.

(Non) *Nitella batrachosperma* (Thuillier) Agardh, Syst. Alg. p. 126. 1824. (= *C. vulgaris* Linn., pro synon.).

Nitella batrachosperma (Reich.) Braun, Neue Denkschr. schweiz. Gesell. Naturw. **10**(3): 10. 1847.

Nitella Nordstedtiana Groves, H. & J., Journ. Bot. **28**: 67. 1890.

Nitella batrachosperma Braun; Groves and Bullock-Webster, Brit. Char. **1**: 124. 1920.

LITERATURE FOR NORTH AMERICA:

Nitella batrachosperma: Kützing, Spec. Alg. p. 515. 1849. — Wallman, K. Vets.-Akad. Handl. (1852): 256. 1854. — Allen, Bull. Torrey Bot. Club **2**(3): 10. 1871. — Char. Amer. **2**: 13. 1880. — Char. Amer. **1**: 46 (key). 1888. — Owen, Pl. Nantucket, p. 74. 1888. — Nordstedt, Lunds Univ. Årsskr. **25**(4): 10. 1889. — Allen, Char. Amer. **2**(3): 27. 1896. — Pieters, Bull. U. S. Fish Comm. (1901): 78. 1901. (= *N. tenuissima* fide Wood [90]). — Lilley, Minn. Bot. St. **3:** 79–82, pl. 18. 1903. — Bach, Mich. Acad. Sci., Ann. Rep. **9**: 126. 1907. — Daily, Butler Univ. Bot. St. **6**: 154. 1944.

Plant monoecious, extremely small and delicate, up to about 5 cm. high. Internodes 1–4 times the length of the branchlets. **Sterile and fertile branchlets** 8 in a whorl; 2 (–3) times divided; secondary rays 4–6.

[88] Allen, Characeae Americanae Exsicc., *34*, supplemented from Allen (1896: 26).
[89] Australian Characeae 1. Proc. Roy. Soc. Victoria, N. S. **31**: 1–4, pl. 1–10. 1918.
[90] Wood, Ohio Journ. Sci. **47:** 247. 1947.

Dactyls 3–7, uniformly 2-celled, frequently more than half the length of the entire branchlet. **Gametangia** at the first and occasionally at the second branchlet node, solitary; sometimes enveloped in mucus. **Oogonia** solitary, about 375–450 μ long by 300–350 μ wide; enveloping cells showing 8–9 convolutions; **coronula** minute, 15–25 μ high, persistent. **Oospores** dull yellow-brown, 225–300 μ long, 200–250 μ broad, 175 μ thick; **striations** of 6–8 broad, flanged ridges; **membrane** thin, flexible, and translucent, dull yellow-brown, finely granular at first and later tending to become thick and definitely reticulate. **Antheridia** 175–200 μ in diameter.[91]

ILLUSTRATIONS: Migula (1897: fig. 52), Groves & Bullock-Webster (1920: pl. 15).

EXSICCATAE: Phyc. Boreali-Amer., Fasc. XXXVII, *1849*; Tilden, Amer. Algae, *530*.

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Massachusetts, Allen (1871: 10), Owen (1888: 74); — Michigan, Bach (1907: 126); — Minnesota, Lilley (1903: 79); — Nebraska, Daily (1944: 154).

TYPE LOCALITY: Europe.

The name *Chara batrachosperma* was first validly published by Thuillier (1799: 473). Subsequently, Braun (1847: 10) showed this plant to be identical to *C. foetida* Braun (= *C. vulgaris* Linn.). Agardh (1824: 126) transferred Thuillier's plant to the genus *Nitella*, giving the combination *Nitella batrachosperma* (Thuill.) Ag. (= *C. vulgaris* Linn.). Reichenbach (1830: 794) published the record of a plant determined as *C. batrachosperma* Thuill., which Braun (1847: 10) recognized as a new species, and transferred it to the genus *Nitella* as *N. batrachosperma* (Reich.) Braun, *pro synon*. Kützing (1849: 515) published the first description of Reichenbach's plant. Groves, H. & J. (1890: 67) apparently recognized that both *C. batrachosperma* Reich. and *N. batrachosperma* (Reich.) Braun were preoccupied by Thuillier's and Agardh's names, and redescribed the plant under the name *N. Nordstedtiana* Groves, H. & J. The assigning of the new name is now obligatory under Art. 69 of the "International Rules of Botanical Nomenclature" (1935). Recent students have consistently retained Braun's name, apparently in disregard of the later homonym rule.

33. **Nitella pygmaea** Braun

Nitella pygmaea Braun, Abh. k. Akad. Wiss. Berlin (1882): 65. 1883.

LITERATURE FOR NORTH AMERICA:

Nitella pygmaea: Braun, l.c. — Allen, Char. Amer. **1**: 46 (key). 1888. — Nordstedt, Lunds Univ. Årsskr. **25**(4): 10. 1889. — Allen, Char. Amer. **2**(3): 26, pl. 24. 1896.

Plant monoecious, 2.5–5 cm. high, compact. **Sterile branchlets** 6 in a whorl, twice divided into 3–5 secondary rays (of which one is occasionally simple) and 3–4 tertiary rays (dactyls). **Dactyls of sterile branchlets** 2-celled, including the mucro; penultimate cell and mucro tapering toward apex. **Fertile branchlets** 6, 2–3 times divided, with 2–3

[91] Groves & Bullock-Webster (1920: 124), supplemented from Zaneveld (1940: 80).

terminal dactyls. **Dactyls of fertile branchlets** same as for the sterile. **Gametangia** at the first branchlet node, aggregated, mucus (?). **Oogonia** 2 (–3). **Oospores** yellow-brown, 250 μ long, 210 μ wide; **striations** of 7 faint ridges; **membrane** finely reticulate,[92] the reticulae about 3–6 μ in diameter. **Antheridia** 240–250 μ in diameter.[93]

ILLUSTRATIONS: Braun (1883: pl. 2, fig. 47–49), Allen (1896: pl. 24 — after Braun).

EXSICCATAE: None issued. Specimen: *Liebmann*. Jan. 1843. In paludosis prope Mirador, Mexico (NY), Flora Mexicana.

DISTRIBUTION FOR NORTH AMERICA: **Mexico**: — Mirador (TYPE LOCALITY), Braun (1883: 65).

This species was differentiated by Braun from *N. tenuissima* primarily on the occurrence of the sex organs at the first instead of the second branchlet furcation, and from *N. batrachosperma* (= *N. Nordstedtiana* Groves, of the present paper) by the faint ridges of the oospore. The species was described on the specimen cited as "Mexic. Liebmann. NORDAMERIKA. In paludosis prope Mirador (Fl. Mexic.) Jan. 1843." Nordstedt (1889: 10) added information on the oospore membrane, and concurred with the distinct species.

34. Nitella Asagrayana Schaffner ex Nordstedt apud Braun

Nitella Asagrayana Schaffner (in litt.[94]) ex Nordstedt apud Braun, Abh. k. Akad. Wiss. Berlin (1882): 67. 1883.

LITERATURE FOR NORTH AMERICA:

Nitella Asagrayana: Nordstedt *in* Braun, l.c.: 67. — Nordstedt, Lunds Univ. Årsskr. **25**(4): 11. 1889. — Allen, Char. Amer. **1**: 46 (key). 1888.

Nitella Asagraeana:[95] Allen, Char. Amer. **2**(3): 19 (key), 28 (descr.), pl. 27. 1896.

Plant monoecious (?), 15–20 cm. high, branched. **Sterile branchlets** 6, spreading, 20–30 mm. long, 2 times divided into 4 secondary rays (–5 mm. long), and 3 tertiary rays (dactyls). **Dactyls of sterile branchlets** about 0.5 mm. long, 2–celled, including the sharp terminal mucro (very evanescent, rarely present on old specimens). **Fertile branchlets** 5 (–6) in a whorl, once or twice divided, condensed into spike-like heads

[92] Nordstedt (1889: 10).

[93] Braun (1883: 65).

[94] Nordstedt's original description cites "Nitella Asagrayana Schaffner in litt. sec. Farlow in scedul." Dr. R. M. Wheldon has graciously investigated the records of the Farlow Reference Library and Herbarium pertaining to this specimen, and has assembled the following facts. Schaffner's letter of about 1878 to Nordstedt (or Braun), in which he apparently described his new species and gave the name, was not located. Dr. Farlow, about 1879, wrote to Nordstedt (or Braun), probably giving the substance of Schaffner's description and adding his own criticisms (probably lost). Nordstedt's letter of April, 1880, to Dr. Farlow agreed with Dr. Farlow that Schaffner's plant was only a variety of *N. gracilis*. This letter is extant in the Farlow files. Nevertheless, Nordstedt published a description of this plant in Braun (1883: 67), and accredited Schaffner for the species.

[95] As stated by Allen (1896: 28), Schaffner's original spelling of this species, as it appeared on the specimen, was *Asagraeana*. However, the original description and subsequent works by Nordstedt used *Asagrayana*, so that there is no doubt concerning the intended spelling for the species.

5–6 mm. in diameter,[96] densely enveloped in mucus. **Dactyls of fertile branchlets** 2–3, 2–celled, including a sharp mucro. **Gametangia** isolated at nodes of branchlets. **Oogonia** solitary. **Oospores** 272–290 μ long, 175–190 (–230) μ broad; [97] **striations** of 5–6 sharp, prominent ridges; **membrane** grumous. **Antheridia** about 170 μ in diameter.[98]

ILLUSTRATIONS: Allen (1896: pl. 27).

EXSICCATAE: None issued. Specimen: *J. G. Schaffner*. 1876. In stagnant pools about Morales, near San Luis Potosi, Mexico (FH), *6*, Flora Mexicana.[99]

DISTRIBUTION FOR NORTH AMERICA: **Mexico**: — San Luis Potosi, Nordstedt *in* Braun (1883: 67), Allen (1896: 28) for Morales (TYPE LOCALITY).

Nordstedt's description of this species, which was inserted into Braun's (1883: 67) "Fragmente," was based on the specimen cited by Allen (1896: 28) as "Dr. J. G. Schaffner, 1876. In stagnant pools about Morales, near San Luis Potosi, Mexico [FH] — No. 6, Flora Mexicana (Exsiccatae?)."

35. Nitella intermedia Nordstedt apud Allen

Nitella intermedia Nordstedt apud Allen, Char. Amer. Exsicc. *2*. 1880. (descr.). — Nordstedt, Lunds Univ. Årsskr. **25**(6): 25. 1889.

LITERATURE FOR NORTH AMERICA:

Nitella intermedia: Nordstedt *in* Braun, Abh. k. Akad. Wiss. Berlin (1882): 67. 1883. (nom. nud.). — Allen, Char. Amer. **1**: 6, 28 (fig. 35), 46 (key). 1888. — *in* Bennett, Pl. Rhode Island, p. 58. 1888. — Nordstedt, Lunds Univ. Årsskr. **25**(6): 25. 1889. — Allen *in* Britton, Final Rep. State Geol. (N. Jersey) **2**: 356. 1889. — Char. Amer. **2**(3): 19 (key), 27 (descr.), pl. 26. 1896. — Burnham & Latham, Torreya **23**: 4. 1923. — Grier, Amer. Midl. Nat. **9**: 60. 1924–5.

Plant monoecious. **Branchlets** 6–8 in a whorl, 2–3 times divided. **Dactyls** 3, 2 (–3)–celled; apical cell an elongated mucro. **Gametangia** in all divisions of the branchlets, solitary. **Oogonia** (dimensions not given). **Oospores** about 360 μ long; **striations** of 8 slightly prominent ridges; **membrane** densely granular-punctate. **Antheridia** 240 μ in diameter.[100]

ILLUSTRATIONS: Allen (1896: pl. 26).

EXSICCATAE: Allen, Char. Amer. Exsicc. 2; Phyc. Boreali-Amer., Fasc. XXXVII, *1841*.

DISTRIBUTION FOR NORTH AMERICA: **United States**: — New Jersey, Nordstedt *in* Allen (Char. Amer. Exsicc. *2*) for "Morris Pond" (TYPE LOCALITY), Allen *in* Britton (1889: 356); — New York, Burnham & Latham (1923: 4), Grier (1924–5: 60); — Rhode Island, Allen *in* Bennett (1888: 58).

This plant was first described (presumably) by Nordstedt in a diagnosis printed on the label of the specimen in Allen's Characeae Americanae

[96] Nordstedt *in* Braun (1883: 67).
[97] Oospore 300–320 μ long, 270–300 μ broad, according to Nordstedt *in* Braun (1883: 67).
[98] Allen (1896: 28).
[99] According to Allen (1896: 28).
[100] Nordstedt (1889: 25).

Exsicc., No. *2*, as "Nitella intermedia Nordst. Nov. spec.," bearing the collecting data: "Habitat: 'Morris pond,' New Jersey. Coll.: T. F. Allen, M. D. August, 1880." As the first two fascicles of this exsiccatae set were issued in 1880, this is the date of publication of the description. The diagnosis on the label renders the rank for the new name rather ambiguous, by stating "Eunitella, diarthrodactyla, homoeophylla, monoica, gloeocarpa. Subspecies N. mucronata, A. Br. sensu latiore." This would suggest that Nordstedt meant the new name to be interpreted as *Nitella mucronata* subspecies *intermedia*. However, as *N. mucronata* Braun *sensu latiore* was treated as a subgeneric section of *Nitella* by Nordstedt *in* Braun (1883: 11) (= "Mucronatae" Allen (1880: 106)), and as both Allen and Nordstedt employed the full specific status of *N. intermedia* Nordst. in subsequent publications, it is concluded that such was intended in the original diagnosis. Nordstedt (1889: 25) redescribed the plant, using the name *N. intermedia* Nordst.

The writer has found no further monographic confirmation of this species in the literature. The records that appear are confined to floristic lists, based on determinations by Allen.

36. Nitella gracilis (Smith) Agardh

Chara gracilis Smith, Eng. Bot. **30**: pl. 2140. 1810.
Nitella gracilis Agardh, Syst. Alg. p. 125. 1824.

LITERATURE FOR NORTH AMERICA:

Nitella gracilis: Braun, Monatsber. k. Akad. Wiss. Berlin (1858): 358. 1859. — Allen, Bull. Torrey Bot. Club **2**(3): 10. 1871. — Halsted, Proc. Boston Soc. Nat. Hist. **20**: 176. 1879. (pro parte, cf. *N. mucronata* var. *tenuior*, accord. to Allen). — Robinson, Fl. Essex Co., Mass. p. 146. 1880. — Braun, Abh. k. Akad. Wiss. Berlin (1882): 58. 1883. — Allen *in* Bennett, Pl. Rhode Island, p. 58. 1888. — Dame and Collins, Fl. Middlesex Co., Mass. p. 151. 1888. — Allen, Char. Amer. **1**: 46 (key). 1888. — *in* Britton, Final Rep. State Geol. (N. Jersey) **2**: 356. 1889. — Bull. Torrey Bot. Club **21**: 524. 1894. — Char. Amer. **2**(3): 19 (key), 20, 22, 23 (descr.), pl. 21. 1896. — Bull. Torrey Bot. Club **25**: 75. 1898. — Pieters, Bull. U. S. Fish Comm. (1901): 78. 1901. (a doubtful record).

Plant monoecious, very slender. Internodes 1–2 times as long as the branchlets. **Branchlets** 5–6 in a whorl, slender, 2–3 times divided; primary rays equal to about half the total length of the branchlet. **Dactyls** 3–4, of which 1–2 are again forked; 2–3-celled; the penultimate cell tapering somewhat toward the apex; apical cell a narrowly-conical, acute mucro. **Gametangia** frequently occurring at all divisions of the branchlets, not enveloped in mucus. **Oogonia** solitary, about 525 μ long by 350 μ wide; **coronula** persistent, 25–30 μ high. **Oospores** broadly ellipsoidal, 250–300 μ long, 225–250 μ wide, 175–200 μ thick, light brown; **striations** of about 6 rather prominent ridges; **membrane** thin and flexible, bright yellow-brown, very finely granulate. **Antheridia** about 300 μ in diameter.[101]

[101] Groves & Bullock-Webster (1920: 118).

ILLUSTRATIONS: Groves & Bullock-Webster (1920: pl. 13), Allen (1896: pl. 21), Migula (1897: 168).

EXSICCATAE: Phyc. Boreali-Amer., Fasc. XXIV, *1195*.

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Massachusetts, Halsted (1879: 177), Robinson (1880: 146), Dame & Collins (1888: 151); — New Hampshire, Allen (1896: 23); — New Jersey, Allen *in* Britton (1889: 356); — New Mexico, Halsted (1879: 177); — Rhode Island, Allen *in* Bennett (1888: 58); — Texas, Braun (1883: 58); — Vermont, Halsted (1879: 177), Allen (1896: 23); **Canada**: — Quebec, Braun (1883: 58), Allen (1896: 23).

TYPE LOCALITY: Europe.

The first appearance of the name *Chara gracilis* in the literature was the description by Smith (1810: pl. 2140) based on the specimen cited as ". . . .gathered Sept. 4, 1809, in a boggy pool in St. Leonard's forest, Sussex (England), by Mr. W. Borrer." Agardh (1824: 125) transferred the plant to the genus *Nitella*.

Nitella gracilis forma **divaricata** Migula

Nitella gracilis forma *divaricata* Migula *in* Rabenhorst, Krypt. — Fl. Deutschl. ed. 2: **5**: 170. 1897.

LITERATURE FOR NORTH AMERICA:

Nitella gracilis forma *divaricata*: Allen, Char. Amer. **2**(3): 23. 1896.

This form is characterized by the elongated stem, 415 μ in diameter, unbranched, and bearing remote whorls of leaves. Branchlets 6 in a whorl; primary ray half the length of the entire branchlet; secondary rays 6; tertiary rays 4–5; quaternary rays 4 [2–3?]. Dactyls 2–3, quite long, and usually 3-celled, sometimes again furcate; terminal cell a mucro about 25 μ in diameter and 60–65 μ long. Gametangia isolated at second and third nodes of the branchlets. Oogonia isolated. Oospores 260 μ long, 220 μ wide, striations (number not given) prominent; membrane (data not given). Antheridia (data not given).[102]

ILLUSTRATIONS: Migula (1897: 168).

EXSICCATAE: None. Specimen: *Josiah Hale*, Louisiana, as *Chara foliosa* (NY) (FH) (MO).

DISTRIBUTION FOR NORTH AMERICA: **United States**: — Louisiana, Allen (1896: 23).

TYPE LOCALITY: Europe.

This form was described by Migula (1897: 170) based on the specimen cited as "Bei Löwenberg in Schlesien 1865 von Cantor Dressler gesammelt."

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[102] Allen (1896: 23).

EXSICCATAE CITED

Allen, T. F. 1880–1893.[103] Characeae Americanae Exsiccatae, Fasc. I–V.
————. 1895–1898.[103] Characeae Japonicae Exsiccatae, Fasc. I, II.
Braun, A., L. Rabenhorst and **E. Stizenberger.** 1857–1878. Die Characeen Europas (Exsicc.), Fasc. I–V.
Collins, F. S., I. Holden and **W. A. Setchell.** 1895–1919. Phycotheca Boreali-Americana, Fasc. I–XLV, A–E.
Nordstedt, C. F. O., and **L. J. Wahlstedt.** 1871–1874. Characeae Scandinaviae Exsiccata, Fasc. I–III.
Tilden, Josephine E. 1894–1909. American Algae, Fasc. I, Cent. 1–7.

LITERATURE CITED

Agardh, C A. 1824. Systema Algarum **I.** Lund.
————. 1825. Observations sur le genre Chara. Ann. Sci. Nat. **4**: 61–66.
————. 1826. Ueber die Anatomie und den Kreislauf der Charen. Nov. Act. Acad. Leop. Carol. **13**: 113–162.
Allen, G. O. 1940. IX. Charophyta, *in* The Percy Sladen Trust Expedition to Lake Titicaca in 1937. Trans. Linn. Soc. London 1^3: 155–160.
Allen, G. O. and **W. G. Herter.** 1934. Charales Uruguayensis. Revista Sudamericana de Bot. **1**: 87–91.
Allen, T. F. 1871. Characeae. Bull. Torrey Bot. Club **2**(3): 9–10.
————. 1879. Characeae Americanae **1**: pl. 1. **2**: pl. 2. New York.
————. 1880. The Characeae of America **1**: 1–8, pl. 1–3. **2**: 9–14, pl. 4–6. Boston. (Certain pages bear the title "Characeae Americanae.")
————. 1880. Similarity between the Characeae of America and Asia. Bull. Torrey Bot. Club **7**: 105–107.
————. 1882. Development of the cortex in Chara. Ibid. **9**: 37–47, pl. 15–22.
————. 1883. [Notes on the Characeae of Lawlor's Lake] (Lacustrine formation of Torryburn Valley). Bull. Nat. Hist. Soc. New Brunswick 1^2: 9–15.
————. 1883. Notes on the American species of Tolypella. Bull. Torrey Bot. Club **10**: 109–117, pl. 37–42.
————. 1887. Some notes on Characeae. Ibid. **14**: 211–215, pl. 71–75.
————. 1888. The Characeae of America **1**: 1–64, fig. 1–54. New York.
————. 1888. Nitella (not Tolypella) Macounii. Bull. Torrey Bot. Club **15**: 11.
————. 1889. Characeae, *in* N. L. Britton, Catalogue of plants found in New Jersey. Final Rep. State Geologist (N. Jersey) **2**: 356, 357.
————. 1892. The Characeae of America **2**(1): 1–8, pl. 1–8. New York. [For the basis used in numbering these plates, see under "Notes."]
————. 1892. Notes on some Characeae. Bull. Torrey Bot. Club **19**: 230.
————. 1892. *In* R. S. Williams, The flora of a Montana pool. Ibid. **19**: 192–194.
————. 1893. Notes on new Characeae. Ibid. **20**: 119–120.
————. 1893. Notes on some Characeae. Ibid. **20**: 258.
————. 1894. The Characeae of America **2**(2): 9–17, pl. 9–17. New York.
————. 1894. Remarks on Chara gymnopus A. Br. with descriptions of new species of Chara and Nitella. Bull. Torrey Bot. Club **21**: 162–167, pl. 185–192.
————. 1894. Japanese Characeae. Bull. Torrey Bot. Club **21**: 523–536.
————. 1895. Japanese Characeae II. Ibid. **22**: 68–71.
————. 1896 . The Characeae of America **2**(3): 19–28, pl. 18–27. New York.
————. 1896. Nitella subspicata sp. nov. Bull. Torrey Bot. Club **23**: 6–7, pl. 253.
————. 1896. A new species of Nitella, belonging to the Nitella flexilis series, with a review of the allied species. Ibid. **23**: 533, pl. 285, 286.
————. 1896. New species of Nitella belonging to the monoecious acuminatae group, with a review of the allied species. Ibid. **23**: 534–536, pl. 285, 286.
————. 1898. Contributions to Japanese Characeae III. Ibid. **25**: 73–82.

[103] See Wood, Farlowia **3**: 327–329. 1948, for proposed dates for Allen's exsiccatae.

————. 1901. Characeae, *in* C. Mohr, Plant life of Alabama. Contrib. U. S. Nat. Herb. **6**: 1–921. [p. 147]. (Reprinted in Geol. Survey of Alabama.)

Amici, G. B. 1827. Descrizione di alcune specie nuove di Chara. (Reprinted in Mem. Accad. Sci. Modena **1**: 199–221, pl. 1–5. 1833.)

Bach, Ellen B. 1907. The Characeae of Michigan. Mich. Acad. Sci., Ann. Rep. **9**: 126.

Barton, W. P. C. 1818. Compendium Florae Philadelphicae **2**. Philadelphia.

Bennett, J. L. 1888. Plants of Rhode Island. Providence.

Bigelow, J. 1824. Florula Bostoniensis, ed. 2. Boston.

Bischoff, G. W. 1828. Die kryptogamischen Gewächse, mit besonderer Berücksichtingung der Flora Deutschlands und der Schweiz. Nürenburg.

Braun, A. 1834. Esquisse monographique de genre Chara. Ann. Sci. Nat. **1**^{2}: 349–357.

————. 1835. Uebersicht der genauer bekannten Chara-Arten. Flora **18**: 49–73.

————. 1843. Charae Preissianae adiectis reliquis speciebus e nova hollandia hucusque cognitis. Linnaea **17**: 113–119.

————. 1844. [A brief notice of the Charae of North America]. Amer. Journ. Sci. and Arts **46**: 92, 93.

————. 1845. [Additional notices of the North American Charae], *in* G. Engelmann and A. Gray. Plantae Lindheimerianae. Boston Journ. Nat. Hist. **5**: 264.

————. 1847. Uebersicht der schweizerischen Characeen. Neue Denkschr. schweiz. Gesell. Naturw. **10**(3): 1–23. [For date: First noticed in Bot. Zeit. **7**: 872. 1849. However, this particular paper was received by Regensb. bot. Gesell. in January 1848, and said to have been issued in 1847 (cf. No. 12 in list of accessions for 1848, Flora **31**: 88). Signature date in original publication is given as "Juni 1847."]

————. 1849. Charae australes et antarcticae. Hooker's Journ. Bot. and Kew Gard. Misc. **1**: 193–203.

————. 1849. Characeae Indiae orientalis et insularum maris pacificis. Ibid. **1**: 292–301.

————. 1859. Characeen aus Columbien, Guyana und Mittelamerika. Monatsber. k. Akad. Wiss. Berlin (1858): 349–367.

————. 1860. Characeae, *in* J. D. Hooker, Flora Tasmaniae **2**. London.

————. 1866. Characeen, *in* G. von Martens. Die preussische Expedition nach Ost-Asien., Bot. Theil. "Die Tange." p. 143. Berlin.

————. 1867. Conspectus Systematicus Characearum Europaearum. Dresden.

————. 1867. Characeae, *in* J. D. Hooker. Handbook of the New Zealand Flora. London.

————. 1868. Die Characeen Afrika's. Monatsber. k. Akad. Wiss. Berlin (1867): 782–801, 873–944.
(Reprinted and repaged consecutively from 782–872. This pagination was followed in references cited in Braun's "Fragmente" (1883).)

————. 1876. Characeen (Armleuchter-Gewächse), *in* F. Cohn. Kryptogamen-Flora Schlesien, **1**. Breslau.

————. 1883. Fragmente einer Monographie der Characeen. Nach der hinterlassenen Manuscripten A. Braun's herausgegeben von Dr. O. Nordstedt. Abh. k. Akad. Wiss. Berlin (1882): 1–211, pl. 1–7.
(Nordstedt added certain portions to the original work. These were set off by brackets — cf. Nordstedt *in* Braun.)

Brébisson, A. 1859. Flore de la Normandie. ed. 3. Caen.

Briquet, J. et al. 1935. International Rules of Botanical Nomenclature. Jena. (cf. Camp, et al. 1947.)

Britton, N. L. 1884. On the composition and distribution of the flora of New Jersey. Bot. Gaz. **9**: 156.

Bruzelius, A. 1824. Observationes in Genus Charae. (Dissert.). Lund.

Burnham, S. H., and **R. A. Latham.** 1923. The flora of the town of Southold, Long Island, and Gardiner's Island, New York. Torreya **23**: 3–9.

Camp, W. H., H. W. Rickett and **C. A. Weatherby.** 1947. International Rules of Botanical Nomenclature. Brittonia **6**: 1–120.

Candolle, de, A. B. 1805. *In* J. B. Lamark. Flore Francaise **6**: 246. [Certain editions were mistakenly dated 1815 on the front page (cf. Journ. Bot. p. 431. 1896).]

Chevallier, F. F. 1827. Flore Génerale des Environs de Paris **2**: 123–128. Paris.

Clark, J. 1852. Catalogue of flowering plants and ferns observed in the vicinity of Cincinnati. Cincinnati.

Collins, F. S. 1894. Algae, *in* E. L. Rand and J. H. Redfield. A Preliminary Flora of Mount Desert, Maine. Cambridge.

Crépin, F. 1863. Les Characées de Belgique. Bull. Soc. Roy. Bot. Belg. **2**: 115–131. (Reprinted and repaged 1–21.)

Daily, Fay Kenoyer. 1944. Characeae of Nebraska. Butler Univ. Bot. St. **6**: 149–171.

————. 1945. The Characeae of Indiana — A preliminary report. Butler Univ. Bot. St. **7**: 124–131.

Dame, L. L., and **F. S. Collins.** 1888. Flora of Middlesex County, Massachusetts. Malden.

Day, D. F. 1883. The plants of Buffalo and its vicinity. Bull. Buffalo Soc. Nat. Hist. **4**: 65–254.

Desvaux, N. A. 1809. Essai sur la Géographie-Botanique du Haut-Poitou (Departement de la Vienne). Plantes trouvées dans le Haut-Poitou, les unes nouvelles, les autres, point indiquées dans la Flore de France. Journ. de Bot. **2**: 290–318.

————. 1810. *In* Loiseleur-Deslongchamps. Notice sur les Plantes à ajouter à la Flore de France. pp. 135–138. Paris.

————. 1818. Observations sur les plantes des environs d'Angers. Paris.

Eaton, A. 1824. A Manual of Botany for the Northern States. ed. 4. Albany.

Eaton, A. and **J. Wright.** 1840. North American Botany. Troy.

Eaton, D. C. 1871. *In* Watson. Bull. U. S. Geol. Expl. Fortieth Parallel. **5**: 398.

Elliott, S. 1824. Sketch of the Botany of South Carolina and Georgia **2**. Charleston.

Farlow, W. G. 1883. Notes on the Cryptogamic flora of the White Mountains. Appalachia **3**: 232–252.

Frost, C. C. 1875. Characeae, *in* E. Tuckermann and C. C. Frost. A Catalogue of Plants Growing Without Cultivation Within Thirty Miles of Amherst College. Amherst.

Ganterer, U. 1847. Die bisher bekannten österreichischen Charen. (Dissert.). Vienna.

Gay, C. 1854. Historia Fisica y Politica de Chile: Botanica **6**. Paris and Santiago.

Grier, N. M. 1924–5. The geology of Long Island with especial reference to the Cold Spring Harbor Region and its flora. Amer. Midl. Nat. **9**: 1–265.

Groves, H. and **J.** 1880. A review of the British Characeae. Journ. Bot. **18**: 97–103, 129–135, 161–167, pl. 207–210.

————. 1883. Notes on the British Characeae. Journ. Bot. **21**: 20–23.

————. 1890. Notes on the British Characeae. Journ. Bot. **28**: 65–69, pl. 296.

————. 1911. Characeae, *in* Ignaz Urban. Symbolae Antillanae, seu Fundamenta Florae Indiae Occidentalis **7**(1): 30–44. Berolini.

Groves, J. 1935. The primary divisions of the genus Nitella. Journ. Bot. **73**: 46–49.

Groves, J. and **G. R. Bullock-Webster.** 1920. British Charophyta **1**. London.

————. 1924. Ibid. **2**. London.

Halsted, B. D. 1879. Classification and description of the American species of Characeae. Proc. Boston Soc. Nat. Hist. **20**: 169–190.

Hartman, C. J. 1846. Handbok i Skandinaviens Flora, ed. 5. Stockholm.

Harvey, F. L. 1895. Contribution to the Characeous Plants of Maine 1. Bull. Torrey Bot. Club **22**: 397–398.

Hornemann, J. W. 1819–1840. *In* Flora Danica, pl. 1656, 1940, 1941, 2311. Copenhagen.

James, J. F. 1879. Catalogue of the flowering plants, ferns and fungi growing in the vicinity of Cincinnati. Journ. Cincinnati Soc. Nat. Hist. **2**: 42–68.

Krocker, A. J. 1814. Florae Silesiacae **3**. Breslau.
(Other volumes were titled "Flora Silesica.")

Kützing, F. T. 1843. Phycologia Generalis oder Anatomie, Physiologie und Systemkunde der Tange. Leipzig.

————. 1845. Phycologia Germanica. Nordhausen.

————. 1849. Species Algarum. Leipzig.

————. 1857. Tabulae Phycologicae, oder Abbildungen der Tange **7**. Nordhausen.

Leiberg, J. 1886. Notes on some of the rare plants found in the Blue Earth and Pipestone counties, Minnesota, during the summer of 1882. Bull. Minn. Acad. Nat. Sci. **3**: 37–38.

Leonhardi, von, H. 1863. Die böhmischen Characeen. Lotos **13**: 55–80, 110–111.

————. 1863. Weitere Characeen-Fundorte. Lotos **13**: 129–132.

————. 1864. Die bisher bekannten österreichischen Armleuchter-Gewächse. Verhandl. naturf. Vereins Brünn **2**: 122–224.
(Reprinted and repaged 1–106.)

Lilley, G. 1903. Nitella batrachosperma in Minnesota. Minnesota Bot. St. **3**: 79–82, pl. 18.

Lillick, L. C. 1937. Freshwater algae from Texas. Pap. Michigan Acad. Sci. Arts & Lett. **22**: 142–152, pl. 17, 18.

Linnaeus, C. 1753. Species Plantarum **2**: 1157.

Migula, W. 1890–1897. Die Characeen Deutschlands, Oesterreichs und der Schweiz, *in* L. Rabenhorst. Krypt.-Fl. Deutschl. Oesterr. und der Schweiz. ed. 2. **5**.

Miquel, F. A. G. 1840. Algae, *in* H. C. van Hall. Flora Belgii Septentrionalis **2.** Amsterdam.

Nees von Esenbeck, C. G. 1818. Chara capitata, eine neue Art von Armleuchter nebst Bemerkungen über die Fruchtteile der Gattung. Denkschr. k. beierisch. bot. Gesell. **2**: 64–83.

Nordstedt, C. F. O. 1880. De Algis et Characeis 2. Lunds Univ. Årsskr. **16**: 15–20.

————. 1883. *In* A. Braun. Fragmente einer Monographie der Characeen. Nach der hinterlassenen Manuscripten A. Braun's herausgegeben von Dr. O. Nordstedt. Abh. k. Akad. Wiss. Berlin (1882): 1–211, pl. 1–7.
(As stated in the introduction to this work, Nordstedt retained Braun's original manuscripts without alteration. Additions made by Nordstedt were set off by brackets. These included several new species and subspecific forms. The "Clavis synoptica Characearum" was also written by Nordstedt. The inconsistencies in nomenclature which exist between portions written by the two authors have apparently been interpreted by certain workers as inconsistencies in Braun's treatment. Upon this basis such workers have found grounds for changes in orthography of names. Such conclusions are untenable.)

————. 1889. De Algis et Characeis 4–6. Lunds Univ. Årsskr. **25**: 2–41, pl. 1.

————. 1889 Characeae, *in* E. von Askenasy, Algen, *in* Die Forschungsreise S. M. S. "Gazelle," IV. Theil. Berlin.
(Characeae, p. 4–8.)

————. 1918. Australasian Characeae 1. Proc. Roy. Soc. Victoria N. S., **31**: 1–4, pl. 1–10.

Northrop, J. I. and **Alice B. Northrop.** 1890. Plant notes from Tadousac and Temiscouata County, Canada. Bull. Torrey Bot. Club **17**: 27–32.

Nuttall, T. 1818. The Genera of North American Plants **2**. Philadelphia.

Owen, Maria L. 1888. A Catalogue of Plants Growing Without Cultivation in the Country of Nantucket, Mass. Northampton.

Palmer, C. M. 1929. Algae of Indiana — A classified check list of those published between 1875 and 1928. Proc. Ind. Acad. Sci. **38**: 109–121.

Peck, C. H. 1869. Characeae. Ann. Rep. State Cab., N. Y. **22**: 55.

————. 1874. Characeae. Ann. Rep. N. Y. State Mus. Nat. Hist. **26**: 48.

————. 1883. Characeae. Ibid. **33**: 36.

————. 1885. Characeae. Ibid. **38**: 83–84.

Persoon, C. H. 1807. Synopsis Plantarum **2**. Paris.

Petkoff, S. 1914. Les Characées de Bulgarie. Nuova Notarisia **25**: 35–56. (Reprinted and repaged 3–24.)

Pieters, A. J. 1901. The plants of western Lake Erie. Bull. U. S. Fish Comm. (1901): 57–79, pl. 11–20.
Pound, R. and **F. E. Clements.** 1898. The Phytogeography of Nebraska, ed. 2 (1900). Lincoln.
Prescott, G. W. 1931. Iowa Algae. Univ. Iowa Studies Nat. Hist. 13: 1–235.
Pursch, F. 1814. Flora Americae Septentrionalis. London.
Rabenhorst, L. 1863. Kryptogamen-Flora von Sachsen **1**. Leipzig.
Ravenel, H. W. 1876. Nitella praelonga, A. Br. Bull. Torrey Bot. Club **6**: 82.
Reichenbach, H. G. L. 1830. Iconographia Botanica **8**. Leipzig.
———. 1832. Flora Germanica Excursoria **1** and **2**. Leipzig.
Richard, L. C. M. 1815. *In* A. Humboldt and A. J. A. Bonpland. Nova Genera et Species Plantarum. Paris.
Riddell, J. L. 1835. A Synopsis of the Flora of the Western States. Cincinnati.
Robinson, C. B. 1906. The Chareae of North America. Bull. N. Y. Bot. Gard. **4**: 244–308.
Robinson, J. 1880. The Flora of Essex County, Massachusetts. Salem.
Ruprecht, F. J. 1845. Distributio Cryptogamarum vascularium in Imperio Rossico. Beiträge zur Pflanzenkunde des russischen Reiches **3**: 7–18. Petrograd.
———. 1846. Symbolae ad historiam et geographium plantarum Rossicarum. Petrograd.
Sawyer, Lucille. 1926. Charophyta of the Lake Okoboji Region. M. S. Thesis. State Univ. Iowa.
Smith, B. H. 1932. The Algae of Indiana. Proc. Ind. Acad. Sci. **41**: 177–206.
Smith, J. E. 1796–1810. English Botany. (Illustrated by J. Sowerby.) pl. 336, 463, 1070, 1703, 1855, 2140. London.
Smith, J. G. and **R. Pound.** 1893. Flora of the Sand Hill Region of Sheridan and Cherry Counties. Bot. Survey Nebraska **2**: 1–30. Lincoln.
Smyth, B. B. 1893. Additions to the flora of Kansas. Trans. Kansas Acad. Sci. **13**: 96–103.
Stewart, Laurie M. 1937. Studies in the life history of Nitella hyalina Agardh. Journ. Elisha Mitchell Sci. Soc. **53**: 173–190, pl. 16–19.
Taylor, W. R. 1921. Additions to the flora of Mount Desert, Maine. Rhodora **23**: 65–68.
Thuillier, J. L. 1799. La Flore des Environs de Paris, ed. 2. Paris.
Wallman, J. 1854. Försök till en systematisk uppställning af växtfamiljen Characeae. K. Vets.-Akad. Handl. (1852): 229–331.
(French translation by **W. Nylander.** Essai d'une exposition systematique de la famille des Characées. Act. Soc. Linn. de Bordeaux **21**[3]: 1–90. 1856.)
Wallroth, C. F. W. 1815. Annus Botanicus. Halle.
Ward, L. F. 1881. Guide to the flora of Washington and vicinity. Bull. U. S. Nat. Mus. **22**.
Webber, H. J. 1889. The freshwater algae of the plains. Amer. Nat. **23**: 1011–1013.
———. 1890. Catalogue of the flora of Nebraska. Ann. Rep. Nebraska State Board Agric. (1889): 175–302.
———. 1892. Appendix to the catalogue of the flora of Nebraska. Trans. Acad. Sci. St. Louis **6**: 1–47.
Willdenow, C. L. 1805. Du genre nommé Chara. Mém. Acad. Roy. Berlin (1803): 79–90, pl. 1, 2.
———. 1806. Ueber die Gattung Chara. Samml. deutsch. Abhandl. k. Akad. Wiss. Berlin (1803): 54–62.
———. 1809. Fünf neue Pflanzen Deutschlands. Gesell. nat. Freunde **3**: 298.
Wood, A. 1880. A Class-Book of Botany, ed. 2. New York.
Wood, R. D. 1947. The Characeae of the Put-in-Bay region, Lake Erie (Ohio). Ohio Journ. Sci. **47**: 240–258, pl. 1–4.
———. On Rafinesque's names for the Characeae. Bull. Torrey Bot. Club **75**(3): 282–285. 1948.

———. 1948. Proposed dates for T. F. Allen's Exsiccatae (Characeae). Farlowia **3**: 327–329.

Woods, A. F. 1894. Characeae, *in* Flora of Nebraska **2:** 122–128, pl. 25–36. Lincoln.

Zaneveld, J. S. 1940. The Charophyta of Malaysia and adjacent countries. Blumea **4**: 1–224, fig. 1–20.

Zeller, G. 1876. Algae Brasiliensis, *in* Symbolae ad Floram Brasiliae Centralis Cognoscendam **22**: 428.

EXPLANATION OF PLATE I

Range of variation in certain characters of Nitella

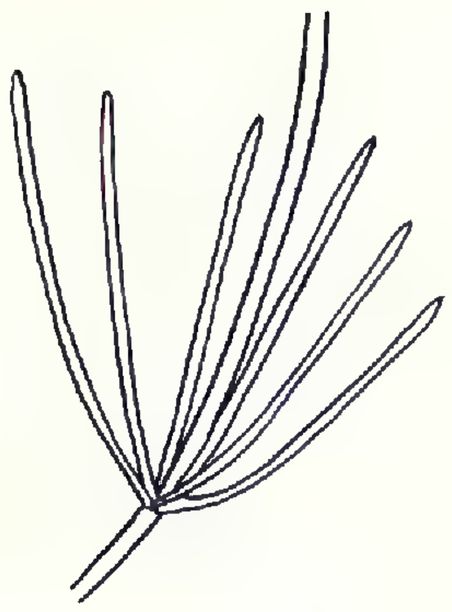
Fig. 1–A — 1–F, Branchlets of a whorl: **1–A**, Homoeophyllous, branchlets simple. **N. californica**, sterile branchlets of a lower whorl, × 0.5 (after Allen (1894: pl. 185)); **1–B**, Homoeophyllous, branchlets once divided or furcate, **N. opaca**, × 0.8 (after Allen (1892: pl. 1)); **1–C**, Somewhat heterophyllous, some branchlets divided, others not divided, **N. occidentalis,** sterile whorls, × 0.6 (after Allen (1894: pl. 187)); **1–D**, Heterophyllous, **N. clavata**, sterile whorl, × ? (after Braun (1883: pl. 1)); **1–E**, Homoeophyllous, branchlets 2–4 times furcate, **N. gracilis**, showing primary, secondary, tertiary, and quaternary rays, × 0.8 (after Groves & Bullock-Webster (1920: pl. 13)); **1–F**, Heteroclemous, branchlets forming two series, an outer whorl and a smaller inner whorl of accessory branchlets, **N. hyalina**, × 0.8 (after Groves & Bullock-Webster (1920: pl. 16)).

Fig. 2–A — 2–C, Heads of fertile whorls: **2–A**, Heads capitate, in axils of sterile whorls, **N. opaca**, × 0.8 (after Groves & Bullock-Webster (1920: pl. 7)); **2–B**, Heads terminal and axillary, **N. Morongii**, × 0.5 (after Allen (1894: pl. 16)); **2–C**, Heads terminal, enveloped in mucus, **N. praelonga**, × ? (after Allen (1894: pl. 11)).

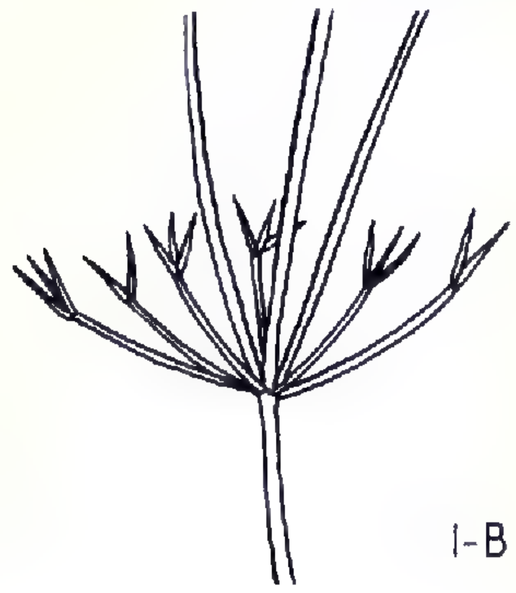
Fig. 3–A — 3–C, Oospore striae (striations): **3–A**, Oospore smooth, striae faint, **N. mucronata** subsp. **virgata** var. **leiopyrena**, × ? (after Braun (1883: pl. 1)); **3–B**, Oospore striae thick, prominent ridges, **N. mucronata** subsp. **virgata** var. **pachygyra,** × ? (after Braun (1883: pl. 1)); **3–C,** Oospore striae prominent and flanged, **N. flexilis**, × 23 (after Groves & Bullock-Webster (1920: pl. 8)).

Fig. 4–A — 4–B, Coronulae of oogonia: **4–A**, Upper tier of coronular cells greatly elongate, **N. dilitata**, × ? (after Allen (1894: pl. 13)); **4–B**, Typical form, **N. tenuissima,** × 264 (after Groves & Bullock-Webster (1920: pl. 14)).

Fig. 5–A — 5–E, Location of gametangia: **5–A**, Antheridium terminal on primary ray in furcation of branchlets (dactyls), **N. opaca**, × 13 (after Groves & Bullock-Webster (1920: pl. 7)); **5–B**, Oogonia aggregate, 3 at a node, enveloped in mucus, plant dioecious (cf. 5–C), **N. capillaris,** × 14 (after Groves & Bullock-Webster (1920: pl. 6)); **5–C**, Antheridium isolated at node, enveloped in mucus, plant dioecious, **N. capillaris**, × 14 (after Groves & Bullock-Webster (1920: pl. 6)); **5–D**, Oogonia geminate, 2 at a node, lateral and below antheridium, plant monoecious, **N. californica**, × 8 (after Allen (1894: pl. 185)); **5–E**, Gametangia lacking at first branchlet division, **N. tenuissima,** ×11 (after Groves & Bullock-Webster (1920: pl. 14)).

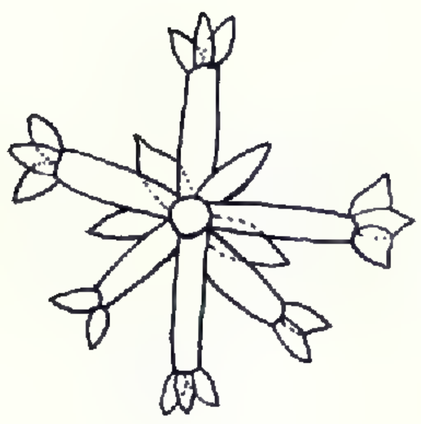


1-A



1-B

1-C



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2-B

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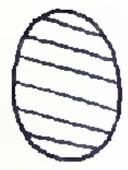
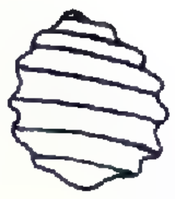


3-B



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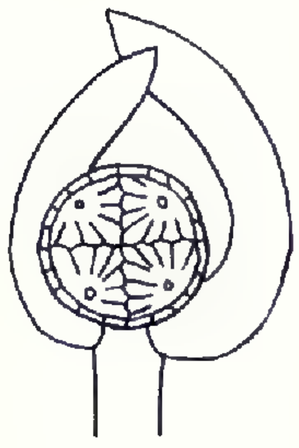

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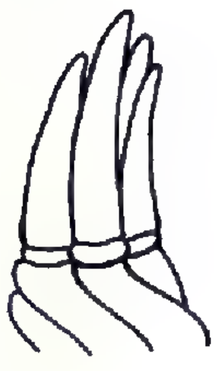

4-B

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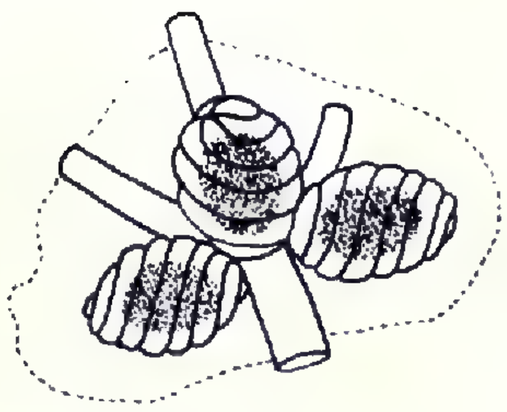
5-B



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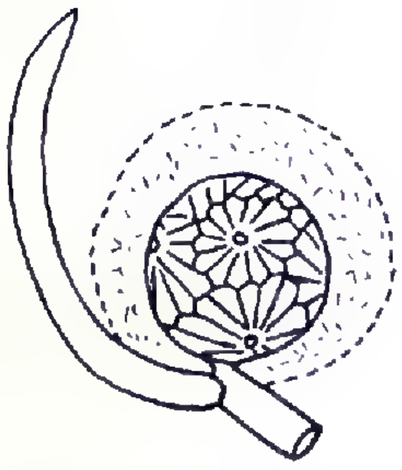

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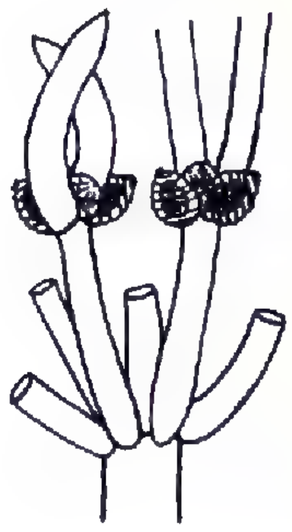


5-E

PLATE I

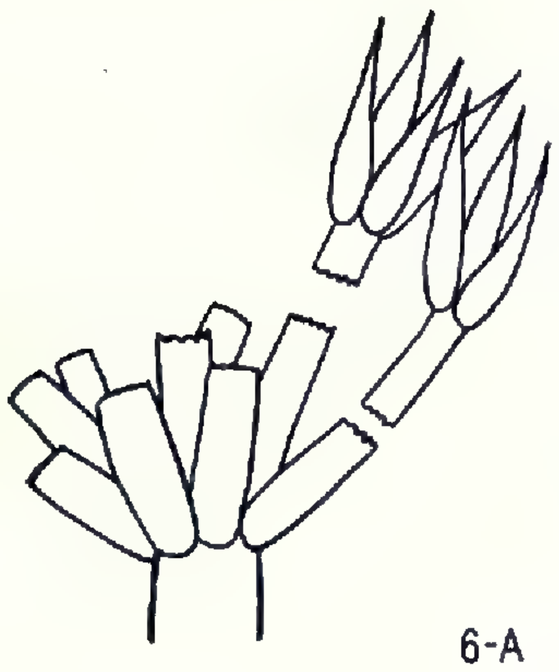
EXPLANATION OF PLATE II

Range of variation in certain characters of Nitella

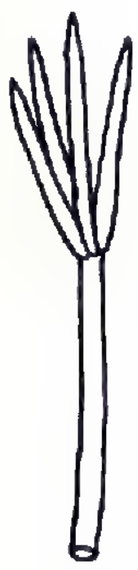
Fig. 6–A — 6–G, Dactyls, the ultimate branchlet rays: **6–A**, Dactyls 1-celled, acuminate, **N. stellaris**, × 11 (after Allen (1896: pl. 285)); **6–B**, Dactyls 1-celled, not abbreviated (cf. 6–C), **N. acuminata** var. **subglomerata**, × ? (after Braun (1883: pl. 1)); **6–C**, Dactyls 1-celled, greatly abbreviated, **N. acuminata** var. **subglomerata** f. **brachyteles**, × ? (after Braun (1883: pl. 1)); **6–D**, Dactyls 1-celled, enormously inflated, **N. clavata** var. **inflata**, × ? (after Braun (1883: pl. 1)); **6–E**, Dactyls 2-celled, mucronate, **N. microcarpa**, × ? (after Braun (1883: pl. 2)); **6–F**, Dactyls indiscriminately 2–3 celled, **N. capillata**, × ? (after Braun (1883: pl. 2)); **6–G**, Dactyls 3-or-more-celled, not mucronate, **N. capillata**, × ? (after Braun (1883: pl 2)).

Fig. 7–A — 7–H, Apices of dactyls: **7–A**, Rounded, blunt, **N. capillata**, × ? (after Braun (1883: pl. 2)); **7–B**, Obtuse, **N. opaca**, × 34 (after Groves & Bullock-Webster (1920: pl. 7)); **7–C**, Acute, **N. opaca**, × 34 (after Groves & Bullock-Webster (1920: pl. 7)); **7–D**, Acuminate, **N. missouriensis**, × 11 (after Allen (1892: pl. 5)); **7–E**, **7–F**, Mucronate, penultimate cell more than 3 times as broad as the base of the mucro, **N. mucronata**, × 24 (after Groves & Bullock-Webster (1920: pl. 12)); **7–G**, Mucronate, but penultimate cell tapering toward apex so that the diameter of the penultimate cell is nearly equal to the base of the mucro at their conjunction, **N. gracilis**, × 48 (after Groves & Bullock-Webster (1920: pl. 13)); **7–H**, Mucro a 4-cuspidate crown, **N. axillaris**, × ? (after Braun (1883: pl. 1)).

Fig. 8–A — 8–H, Oospore membrane patterns in fossae between two striae of outer membrane: **8–A**, Smooth, **N. flexilis**, × ? (after Allen (1892: pl. 6)); **8–B**, Granular, **N. Blankinshipii**, × ? (after Allen (1892: pl. 4)); **8–C**, Minute, non-contiguous tubercles, **N. capillaris**, × ? (after Allen (1894: pl. 9)); **8–D**, Coarsely granular with irregular granulations, **N. acuminata** subsp. **glomerulifera**, × ? (after Allen (1892: pl. 8)); **8–E**, Short, rather rectangular elevations or ridges, **N. Macounii** × ? (after Allen (1894: pl. 14)); **8–F**, Irregularly reticulate, **N. Bastini**, × ? (after Allen (1894: pl. 10)); **8–G**, Reticulate, **N. mucronata**, × 194 (after Groves & Bullock-Webster (1920: pl. 5)); **8–H**, Beaded reticulate with 4–5 reticulae per fossa, **N. transilis**, × ? (after Allen (1896: pl. 23)).

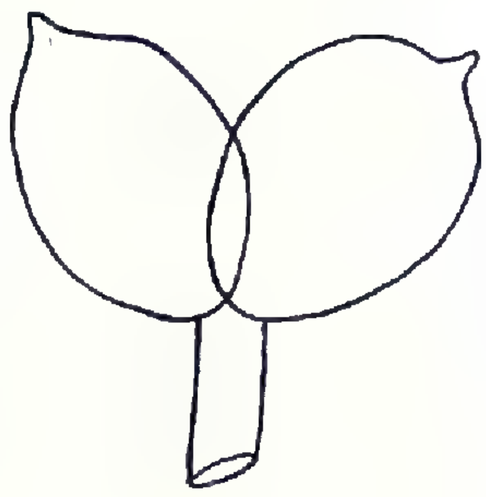


6-A



6-B

6-C



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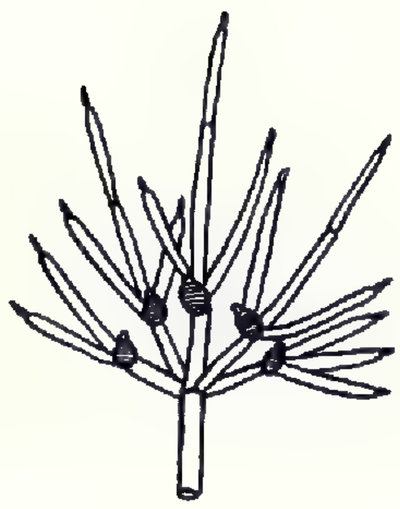
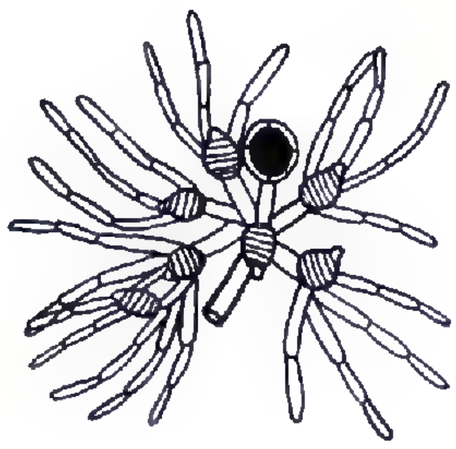


6-E



6-F

6-G

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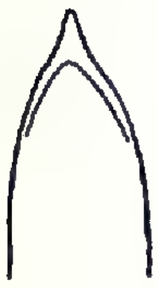
7-B



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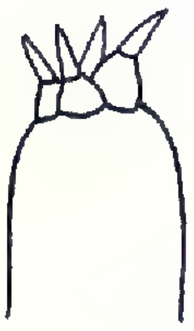

8-H

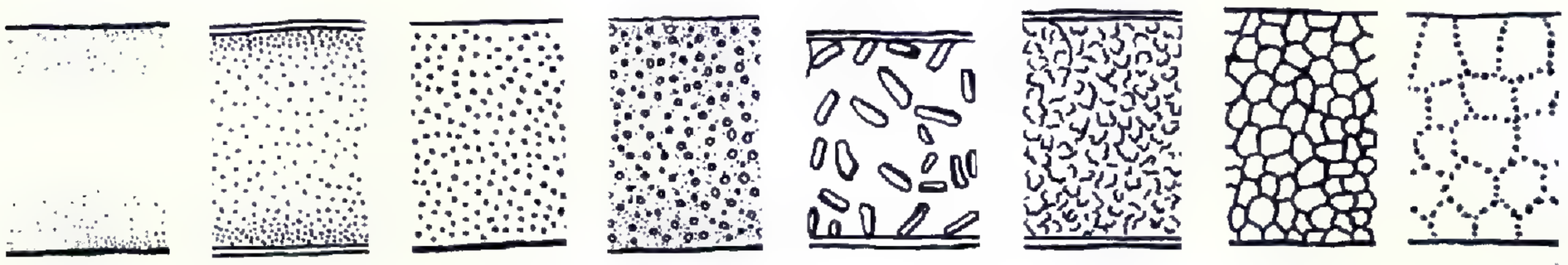

PLATE II

SYNONYMICAL INDEX

Names accepted on nomenclature grounds are printed in **boldface**; synonyms or misidentifications are printed in *italics*; old synonyms which have been subsequently transferred and now form part of accepted new combinations are printed in ***bold italics***; incorrect usages and determinations which have subsequently been changed by later authorities are printed in *italics*, and indicated by "acc." (= according to) the writer who recorded the name. Accepted names of superspecific groups are printed in CAPITALS. The asterisk (*) precedes combinations which are not employed in the present work, but which may prove to be more consistent.

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HISTORY, DISTRIBUTION AND ECONOMIC SIGNIFICANCE OF THE CELLULOSE-DESTROYING FUNGUS MEMNONIELLA ECHINATA *

W. LAWRENCE WHITE, C. C. YEAGER, AND HELEN SHOTTS

INTRODUCTION

Until late in World War II the Dematiaceous species, *Memnoniella echinata*, had remained practically unknown. There were few mycologists who had ever heard of it when, in 1944, an Australian scientific mission to New Guinea named it as a common form moving in to destroy the basic cellulosic ingredients of army tents after other fungi had already destroyed the waterproofing and other finishing materials. To be sure, the species had been discovered and described in Northern Italy some seventy years earlier. But the few records that had appeared in the meantime had been mostly incidental and had been submerged and forgotten. It therefore occasioned some surprise when continued investigation proved the species to be one of the most common forms found on cotton fabrics exposed under unfavorable conditions in the tropics.

Was its geographic range more or less confined to an area of the Southwest Pacific? Was it of general distribution in tropical regions? Or was it of widespread occurrence over the tropic and temperate regions of the world? Why had it remained so obscure during a period of one hundred and fifty years of mycological exploration of Europe and a nearly equal period of similar activity in this country? Was it fundamentally a soil organism and if so why did it not come to light in Gilman's compilation of 1945? What was its relative significance in the deterioration of cotton fabrics and other materials of similar composition or use?

The present paper is based on an analysis of samples of deteriorated fabrics received from numerous military installations, laboratory study of isolates from such samples, personal observation of two of the authors at

* Prepared in 1947 when the authors were employed respectively at the Quartermaster Corps Biological Laboratories, Philadelphia, Pennsylvania, the Materials Laboratory, Air Material Command, Wright Field, Dayton, Ohio, and the Quartermaster Corps Biological Laboratories, Philadelphia, Pennsylvania. Presented in its essentials by the senior author at the A. A. A. S. Meetings in Chicago in December 1947 and revised by him prior to publication; present address: Biological Laboratories, Harvard University.

military installations around the tropical belt of the world, information gained through visits to various army laboratories and research institutions in the same region as well as in this country, and on the examination of herbarium specimens.

PRE-WAR HISTORY

The species was discovered by Rivolta (24) in 1873. His specimen or specimens were taken on hay and wheat culms, presumably dead, in Northern Italy. He described the organism as *Penicillium echinatum*, and furnished in addition to the description, an illustration, which, though perhaps somewhat crude by present day standards, was, nevertheless, very characteristic and quite sufficient to show beyond a doubt that he had a member of the species as we understand the latter today.

In 1886 Saccardo (26) transferred Rivolta's species to *Haplographium* and this and such other standard European works as Rabenhorst's Kryptogamen-Flora (16) and Ferraris' Flora Italica Cryptogama (9) carried it along in that genus, solely on the basis of Rivolta's report, without providing any further information.

A long period of years passed before the species was encountered again. What seems to be the second published account appeared in 1913 in a study by McBeth and Scales (17) of cellulose decomposition by soil and air-borne organisms in Washington, D. C. Cellulose agar plates were exposed to the atmosphere of the laboratory and a clearing of the culture medium was taken as the criterion of cellulolytic activity. This species was listed as one of the fungi giving positive results. In 1918 Graff (11) reported a collection which had been taken in 1912 "on moist paper which was folded together" in Manila, and the same year Stevenson (30) included it in a check list of Porto Rican fungi on the basis of an isolation from soil at Rio Piedras. All three of the foregoing writers used the name *Haplographium echinatum*. Their specimens have not been available for examination but the species is so distinctive that there appears to be no reason for doubting the identifications. It is to be assumed that Graff's specimen, deposited at the Bureau of Science in Manila, was lost in the destruction of that institution.

In 1923, 50 years after Rivolta, von Höhnel (13) found the organism on a piece of cotton yarn in Vienna. This was the fifth recorded encounter with the species in nature. Von Höhnel overlooked the work of Rivolta and, on the basis of his own specimen, described the species again as *Memnoniella aterrima* gen. & sp. nov. A slide preserved in the von Höhnel Herbarium at Harvard University is in excellent condition and confirms the identity of his specimen as typical of the species as we now know it.

From 1926 to 1932 there was some brief mention of the species on the basis of previous literature records only. Seaver and Chardon (28) made reference to the soil isolate from Porto Rico; Thom (31) agreed with Saccardo's removal of it from *Penicillium*; Clements and Shear (8) re-

ferred *Memnoniella* to synonymy under *Hormodendrum* Bon.; and Toro (29), evidently following the Clements and Shear disposition of the various genera involved, transferred the species to *Cephalotrichum* Berk.

In 1933 Galloway (10), working with the British Cotton Industry Research Association, obtained an isolate during an attempt to revive a species of *Stachybotrys* from a heavily mildewed "cop of cotton yarn." The yarn had been kept for some years in a sealed jar. The *Stachybotrys* proved to be dead, but in the course of plating, the *Memnoniella* appeared on the agar, admittedly possibly only as an air contaminant. Galloway studied the isolate carefully, noted the previous works of both Rivolta and von Höhnel, accepted von Höhnel's genus *Memnoniella*, and following the rules of priority, made the combination *M. echinata* (Riv.) Gallow. He further noted a close relationship to *Stachybotrys*.

Hence, at the onset of the war the species had been found on only six different recorded occasions. However, in the following two or three years, but still independent of the war effort, there appeared two significant papers with records of two additional isolates of the organism.

Greathouse, Klemme and Barker (12), in a piece of work aimed largely toward the refinement of a technique for testing the amount and rate of cellulose decomposition by microorganisms, tried several fungi as test organisms and found *Memnoniella echinata*, which they (perhaps not incorrectly) called *Stachybotrys papyrogena*, less satisfactory as a test organism than *Metarrhizium* sp. (since described as *M. glutinosum* Pope and more recently reduced to synonymy under *Myrothecium verrucaria* (Alb. & Schw.) Ditm. ex Fr.) and *Chaetomium globosum* Kunze. The isolate used in this work, USDA #*1331.1*, had been made in 1938 by Dr. Harry Humfeld of the U. S. Department of Agriculture from cotton duck obtained from William H. Hooper Sons Company, Baltimore (personal communication from Dr. Paul Marsh), and which probably had been exposed in Florida (personal communication from the Company).

Following a check list by Wakefield and Bisby (32), which indicated that *Memnoniella echinata* was still known in England only from Galloway's isolate, Bisby (4) presented a paper reviewing the genus *Stachybotrys*. He commented on the closely related *Memnoniella* after examining a subculture of Galloway's original isolate. He noted that, although Galloway's work appeared reasonably accurate, the species, *Memnoniella echinata*, nevertheless, was suspiciously rare; and he inferred that he doubted the existence of such a form as a distinct entity in nature. He further mentioned the possibility that it was only a form of [the perhaps even less well established] *Stachybotrys subsimplex*, in which slime production was reduced to allow retention of the conidia in chains. In addition to Galloway's culture, he mentioned another which had been made from citrus washings in Southern Rhodesia by G. R. Bates.

Even at the time of Bisby's paper, and before the war research program began to throw new light on the species, there was ample herbarium material to establish the form as distinct and of wide tropical and subtropical

distribution. Admittedly this material was not readily accessible. The specimens were in various herbaria of this country and for the most part under such short-of-adequate determinations as "*Stachybotrys* sp." or "*Haplographium* sp." They will not be discussed at this point, since they are listed further along under the heading "Distribution and Material Examined." The regions represented were Costa Rica, Colombia, Venezuela, Brazil, China, and Ceylon. One on banana under "Locality Unknown" was possibly of Trinidad origin. In all cases the organism was on plant parts, presumably growing saprophytically. There were several instances of its having been intercepted at U. S. ports on shipments of economic plants from some of the above tropical regions.

WARTIME INTEREST

Concurrently with Bisby's paper of 1943, there appeared a Report (18) by an Australian Scientific Mission describing the extensive deterioration of military stores and equipment in the eastern part of New Guinea. It was this Report which first aroused widespread interest in the problem of deterioration of military equipment. While the report was rather general in so far as the fungi as such were concerned, and was prepared before a detailed analysis of specific organisms was possible, nevertheless the comments (p. 63) pertinent to the fungi involved were of interest. Those found most frequently on tents, tarpaulins, etc., in service were said to be species of *Aspergillus*, *Penicillium* and *Rhizopus*. It was said to be such a population as this that destroyed the waterproofing and various finishing materials, to be followed later, after the fabrics were already leaking and unserviceable, by members of such genera as *Stachybotrys*, *Memnoniella* and *Chaetomium*, which effected final disintegration of the cotton fibers. In May of 1944 Dr. C. J. Magee, mycologist and senior author of the Report, in a personal communication to Professor W. H. Weston, Jr. of Harvard University, stated that he agreed with Weston that the fungi causing deterioration in the tropics were in general those familiar in temperate regions, but warned against hasty and too definite statements, adding, "*Memnoniella echinata*, for instance, is regarded as one of the most common cellulose-destroying species in New Guinea, and I think should be regarded as a tropical species."

By the middle of 1944 *Memnoniella echinata* was receiving very frequent but more or less incidental mention in mimeographed and typewritten military reports in both this country and abroad. Such references were too numerous for review here and most of them furnished no real information. They did, however, serve to stimulate interest. Most of the knowledge we now have of the species came directly or indirectly as a part of the war effort. Australian workers (2) again mentioned it as "One of the commonest cellulose attacking fungi on material from New Guinea." They recommended it for standard tests of tropic proofing of all cellulosic materials and included it in mold mixtures used for testing electrical equipment,

paper, etc. Martin (20) found it to be one of the worst active cellulose-destroying organisms present in the soils of the Jeffersonville (Indiana) Quartermaster Depot greenhouse. At about the same time the studies which finally resulted in the preparation of the present paper were being started at the Philadelphia Quartermaster Depot.

Early in 1945 Barghoorn (3), in a preliminary survey of the fungus flora of Quartermaster fabrics exposed experimentally under various environmental surroundings in Panama to test the efficiency of protective treatments, found *M. echinata* to be uncommon and in no way significant as determined by the frequency of its appearance in culture. Later in the same year, 1945, Weston (33) reviewed in a general way the fungi that had been isolated during the war from fabrics exposed in the tropics. In a set of 1330 cultures made from fabrics exposed experimentally in Panama, members of the genera *Penicillium*, *Fusarium*, *Trichoderma*, *Pestalotia*, *Pullularia*, and *Botryodiplodia*, in that order of frequency, comprised 63% of the total isolates. *Memnoniella* was obtained only once and there was no *Stachybotrys* or *Chaetomium*. Of 280 identified cultures among a total of 1517 isolated in Florida from materials experimentally exposed there, *Memnoniella echinata* appeared two times, while there were six isolates of *Stachybotrys*. It was further noted, in contrast, that out of one thousand isolates made at the Philadelphia Quartermaster Depot from samples sent in from the Pacific, *M. echinata* appeared thirty-five times. Brien and Dingley (7), in New Zealand, investigated methods for testing preservatives of fabrics. They noted that of the various fungi isolated from fabrics in the Pacific war zone and locally, *Stachybotrys* and *Memnoniella* alone caused appreciable loss in their tests and that *Stachybotrys* was selected for further assessment testing because of its prolific production of black spores on canvas, thus making its presence easily recognizable. Klemme et al (14) tested a number of species of fungi for ability to degrade grey duck. One was *Memnoniella echinata, 1331.1*, which they were still carrying as *Stachybotrys papyrogena*. It showed moderate activity. More or less concurrently with the foregoing contributions Bisby (5) supplemented his 1943 (l. c.) paper with additional brief comments. He noted that in the meanwhile cultures and data received from Dr. Lilian Frazer of Sydney [who was in charge of the Australian Mycological Panel set of cultures from military materials] and R. M. Brien of Auckland (see above) showed that *M. echinata* "is a common fungus, especially on old cloth in certain warmer areas," that the cultures agreed with Galloway's description, and that the species, regularly producing persistent chains of conidia without slime, was distinct from *Stachybotrys subsimplex*. He added that *S. papyrogena* was still unknown. A report from India (1) indicated that *Memnoniella echinata* was commonly isolated from cotton cordage and fabrics in India. And perhaps noteworthy, also, is fig. 206 in the 1945 French text book of Langeron (15) which certainly represents *Memnoniella echinata* and not *Stachybotrys lobulata* as labeled.

The year 1946 brought forth still more information. Zuck (37), made

an interesting observation which opens the way for further genetical and cytological studies. He found that certain cultures of *Memnoniella echinata* produced also typical *Stachybotrys* spores. Branched conidiophores were found which produced on one branch the small globose *Memnoniella* spores in chains devoid of slime, and on the other branch a typical *Stachybotrys* head, i.e., a head with relatively large ellipsoid spores, not in chains, imbedded in slime. Single spore isolates employing either type of spore always reproduced the parent colony type. Zuck, working at Beltsville, Maryland, made incidental mention that *M. echinata* was frequently observed by him and his associates on cloth removed from both soil contacts and above ground exposures ranging from Wisconsin to Louisiana. He further stated that it was found regularly on fabric test specimens removed from soil burial tests using various soils from Maryland, Indiana, Michigan, and Nebraska. His conclusion was that despite limited records it was a common soil species in the United States.

Another contribution of 1946 was a highly significant one by Marsh and Bollenbacker (19) pertaining to the organic growth requirements. A total of six isolates of *M. echinata* and five of *Stachybotrys* sp. all were found to require biotin for growth. They did not, however, require any of an additional list of fifteen other vitamins and related materials. Grey cotton duck appeared to furnish an ample supply of biotin for their cellulolytic activity and growth.

Also in 1946 the senior author, largely as a result of observations on the mycological aspects of deterioration as a member of a Mission sent to the tropics to study the effects of adverse conditions on military materials, briefly pointed out (34, 35) that this species probably was encountered more frequently than any other on such materials as cotton fabrics and cardboard exposed to the weather or in damp storage. Several photographs were presented showing the general growth aspects of the organism on such materials. A contrast was drawn between the behavior of *Memnoniella echinata* and *Metarrhizium glutinosum* (since referred to synonymy under *Myrothecium verrucaria*), the former difficult to work with in the laboratory but finding field conditions quite suited to its development, the latter an exceptionally strong cellulose destroyer and ideal in laboratory experimentation, yet seldom found on fabrics or similar materials in the field. Two years later, in another paper (36), the results of the assay of eleven strains of the species were presented in a table giving also the results of similar tests of numerous other fungi. It is of interest to note that the

PLATE I. Photomicrograph of *Memnoniella echinata* from culture PQMD *421* showing apical portion of conidiophore (lower left) with whorl of phialides, basal part of conidiophore (right center), and chains of conidia with their characteristic octagonal shape in side view. Taken from a potato dextrose agar stock slant (5 grams dext. per 1.) after 24 days under room conditions and mounted in a drop of a 1–1 solution of 95% ethanol and glacial acetic acid, after which a drop of 40% glycerine was run under the cover glass. (Preparation by Mary Downing, Biological Laboratories and photo by A. Wrigley, Microscopy Laboratory, both of Philadelphia Quartermaster Depot, × 990).

PLATE I

cultures of *Memnoniella* tested appeared to fall into two groups, those fruiting profusely at the end of a twelve-day incubation period on a relatively highly purified bleached cotton sheeting and those showing no trace of fruiting, and that those which fruited exhibited the stronger cellulolytic action. In comparison with a large number of miscellaneous fungi isolated from fabrics all the cultures exhibited strong cellulolytic action, which, however, was weaker than that obtained for species of *Chaetomium* and *Myrothecium*.

Since much of the interest in *Memnoniella* was concurrent with the period of concentrated exploration for antibiotics the species also came in for due consideration in this respect. Early in 1947 three strains of *Memnoniella*, PQMD *1c*, *50d*, & *82d* and three of *Stachybotrys*, PQMD *85m*, *94d*, & *134b* were included in a lot of fungi sent by the senior author to Dr. W. J. Robbins for antibiotic assay. They were reported upon (personal communication 3 July 1947) as not showing very great promise. The three strains of *Memnoniella* were inactive against *Staphylococcus aureus*, *Escherichia coli*, and *Mycobacterium smegma*, while the strains of *Stachybotrys* showed some activity against *Staphylococcus aureus* but were inactive against the last two. In June of the same year Brian and Hemming (6) published a series of assays which included three strains of *Memnoniella* and nine of *Stachybotrys*. All were different strains than those used by Robbins. *Memnoniella* and three of the strains of *Stachybotrys* showed no antifungal or antibacterial activity while six strains of *Stachybotrys* showed enough of one or both to warrant further study. Hence the independent findings of the two groups of workers were in rather strict agreement in setting *Memnoniella* aside as showing no promise while strains of *Stachybotrys*, on the whole, did show a certain amount of activity. It may be noted at this point that the earlier statements of Bisby (4, 5) and Zuck (37) mislead Brian and Hemming into suspecting that the two species might be identical.

Marsh's contribution on nutrition was followed closely by a similar study by Perlman (22, 23). Perlman confirmed Marsh's conclusions that *Memnoniella echinata* and *Stachybotrys atra* were similar in many of their physiological characteristics. They were able to grow in solutions of biotin, glucose and mineral salts, to utilize about twenty sugars and derivatives, to grow well with any one of several nitrogen sources and to receive some stimulation from traces of iron, zinc, and manganese. The

PLATE II. *Stachybotrys atra* (A–B) and *Memnoniella echinata* (C–G). A,B, Typical spores of *S. atra*, respectively Australian Mycological Panel *70* and *65*. C, Typical spores of *M. echinata*, AMP *2*. D,E, Mounts from *M. echinata*, AMP *52* and *86* respectively, showing typical globose *Memnoniella* spores and some elongate spores of the *Stachybotrys* type as described by Zuck. F,G, Abnormally proliferated and colored phialides of *M. echinata*, observed in only one culture, PQMD *320b*. All preparations in 7% KOH solution; A,B,D&E from 1-3 month old 0.5% p.d.a. stock slants held for a while under room conditions then at 6°C.; C, from a similar stock slant about 1 year old; F,G, from a 10-day-old stock slant, 2% p.d.a., room conditions. (All preparations and photographs by Mary Downing, F × 440, all others × 1000).

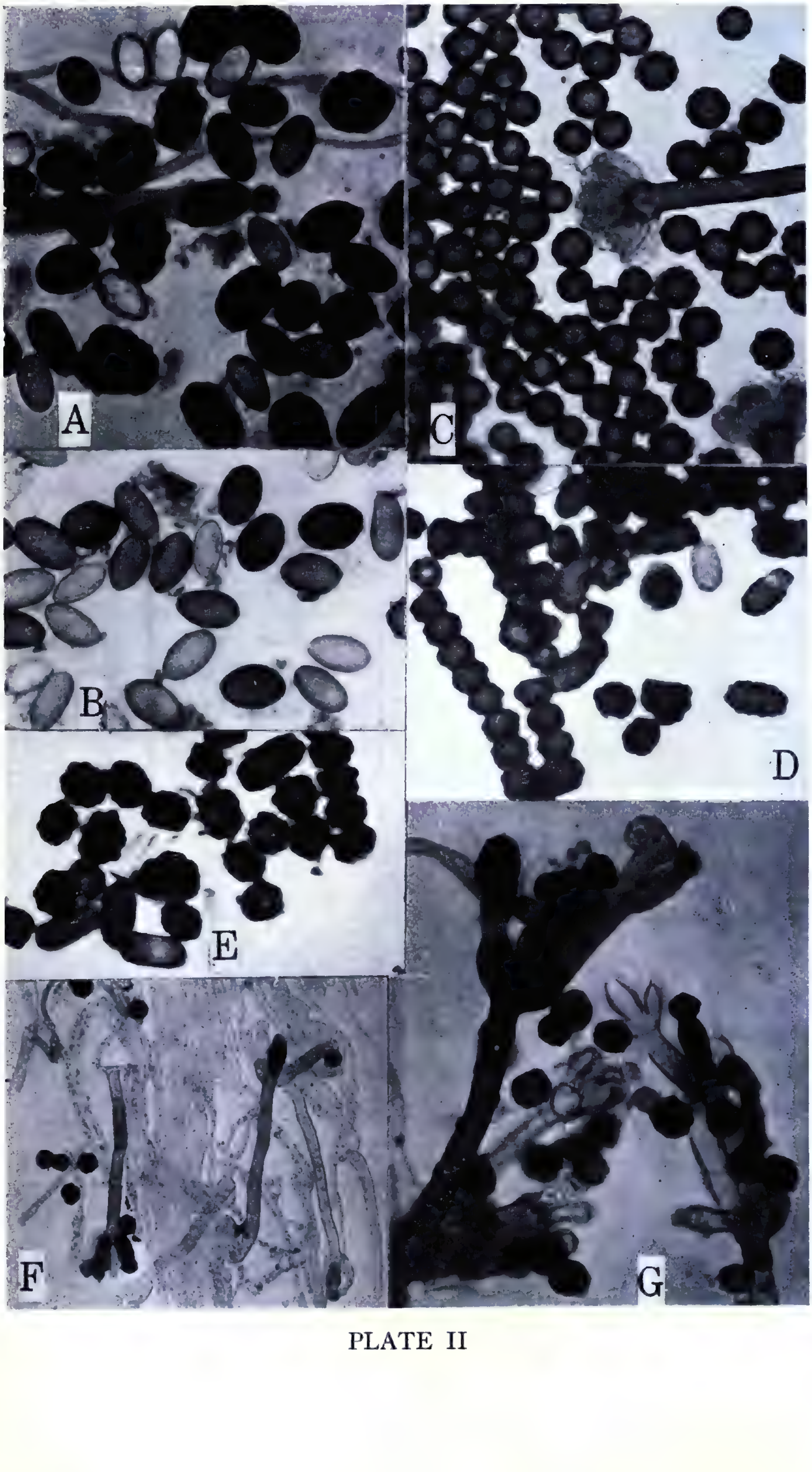

PLATE II

biotin studies of Marsh were extended and other nutritional details were presented.

Romano (25) used *Memnoniella echinata* as one of seven fungi employed in a "spore-rain" technique for testing fabrics but did not make any study of the organisms as such.

Martin (21) found *M. echinata* common on South Seymour Island of the Galapagos group and particularly abundant on dead *Opuntia* stems.

MEMNONIELLA AND STACHYBOTRYS

The morphological distinction between these two genera is that in *Memnoniella* the conidia are globose and borne dry in chains (pl. I, pl. IIC) whereas in *Stachybotrys* they are ellipsoid or typically so (pl. IIA, B), not in chains, and are held in a globular mass of slime which envelops the tips of the phialides. Biologically members of the two genera are very closely related, and in a natural, as opposed to a form-genus classification, the species would have to be considered congeneric.

Memnoniella has always been monotypic, while about 20 species have been described in *Stachybotrys*. Bisby (5) has pointed out that many of the species of Stachybotrys are superfluous, and he has already made a beginning toward their reduction. The number will eventually be reduced to perhaps 3 or 4 valid species. From the strictly economic point of view only one species of *Stachybotrys* is worthy of consideration. It could be definitely identified with the type of any one of several relatively recently described species, but conservative procedure appears to warrant continuance of the more or less generally established practice of referring these forms to *S. atra* Corda. Bisby has done this after critical consideration of the case, despite the fact that Corda's description and illustrations leave much to be desired. Corda's type specimen has never been re-examined.

Pertinent to the purposes of the present paper, then, there are two species, *Memnoniella echinata* and *Stachybotrys atra*. Among the dozens of cultures that have been available, including isolates from throughout the temperate and tropical parts of the world — some made at our own laboratory and some submitted by others — all except two or three fall nicely into one or the other of these two species. With these few exceptions, none have varied from the normal to the extent that they had to be doubtfully disposed of taxonomically, nor have intermediates been noted.

It has been found that when transfers of strains of the two species are

PLATE III. Growth patterns of *Stachybotrys atra* (A–E) and *Memnoniella echinata* (F–J). Grown in parallel series from mass spore transfers for 16 days under room conditions on potato dextrose agar (20 grams dext. per liter) with 35 cc. of the medium in standard 9 cm. petri dishes. A, culture PQMD *94d*; B, PQMD *101a*; C. PQMD *102a*; D, PQMD *104f*; E, PQMD *134b*; F, PQMD *1c*; G, PQMD *50d*; H, PQMD *50g*; I, PQMD *51a*; and J, PQMD *51f*. (By Photographic Division, Philadelphia Quartermaster Depot, × 1).

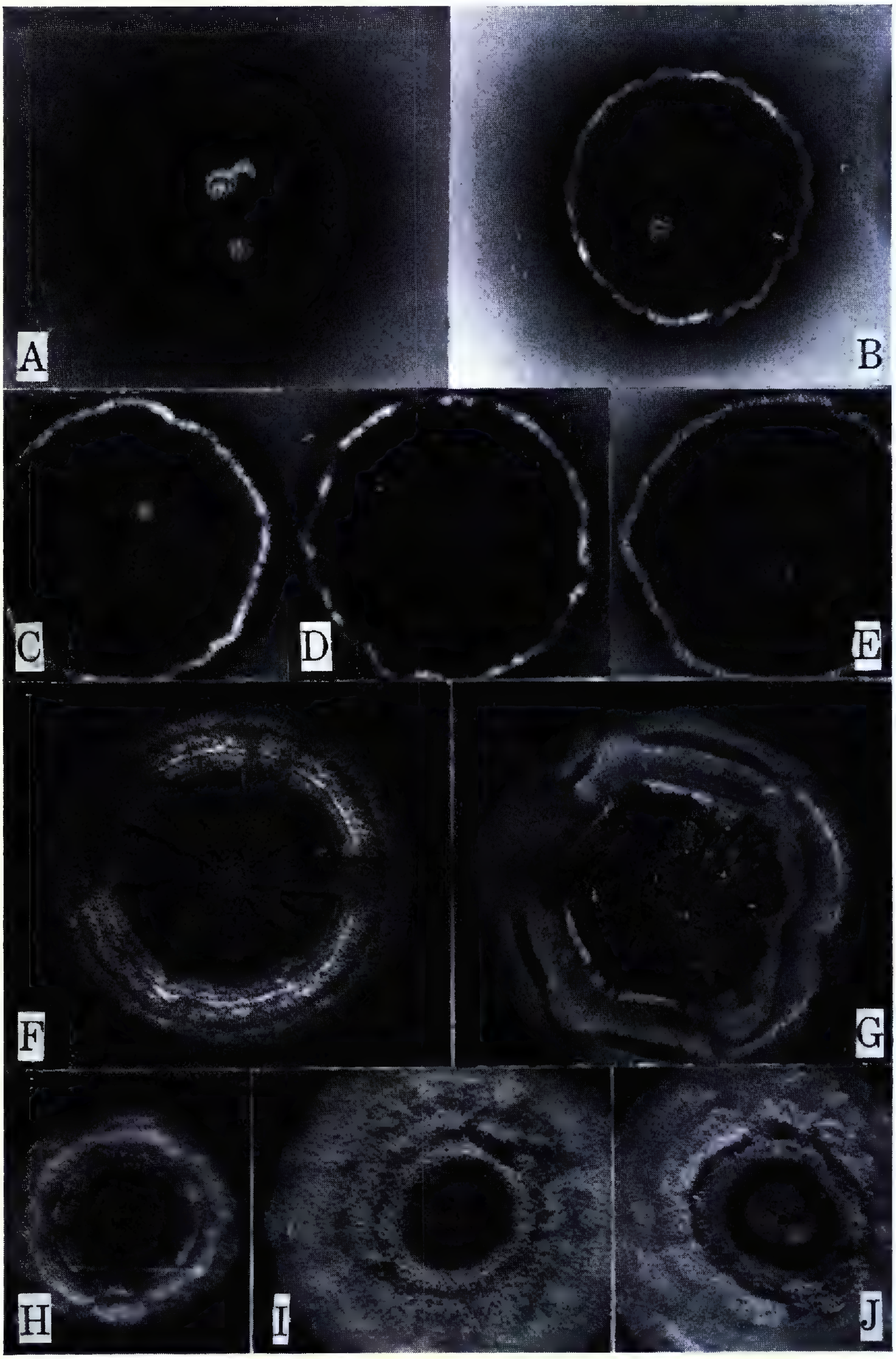

PLATE III

made from stock culture tubes to petri plates containing potato dextrose agar (20 g. dextrose per liter) the resulting colonies fall into two distinct and well defined series (pl. III). Those representing *S. atra* (pl. IIIA-E) quickly form an even, black, heavily sporulating surface surrounded by a distinct narrow white margin. This pattern is maintained until the culture eventually covers the entire surface of the agar medium. The dark halo in the agar immediately surrounding the colony is also a noteworthy characteristic. In *Memnoniella* (pl. IIIF-J) radial growth is at about the same rate, but the surface of the colony for a long time is white, floccose to watery, and sometimes wrinkled. Sporulation is relatively long delayed, finally appearing in a concentrically mottled pattern. No coloring of the agar medium occurs. There are several points of difference in the microscopic characters of the two species. In *Memnoniella* the conidia are borne in long chains (pl. I), are octagonal-globose in side view (pl. I), circular in outline in end view (pl. IIC), have a fairly dark, tuberculate outer wall (epispore) which appears to be an integral part of the body and not easily removed, are borne dry, i.e. not in slime, and measure about 5–6μ in diameter. In *Stachybotrys atra* they are extruded into a mass of slimy material to form a globule of spores and slime which envelops the tips of the phialides, are ellipsoid in outline (pl. IIA, B), vary from smooth to coarsely roughened, the latter condition being caused by the adherence of the dried-down slimy material to form a kind of false outer wall which comes off more or less readily in microscope preparations, and measure about 9–11 x 5–16μ. In *Memnoniella* the conidiophores arise singly from horizontal hyphae, whereas in *Stachybotrys* they arise alternately as branches from a zig-zag hypha, with the whole branch presenting the aspect of a loose raceme.

The observations of Zuck that in certain cultures of *Memnoniella*, typical *Stachybotrys* heads were present and that in certain cultures of *Stachybotrys* typical *Memnoniella* heads were present, the two types sometimes occupying two branches which arise from a common base, is very interesting and is a phenomenon which should be investigated further. Zuck's work, though not so intended, has raised doubt in the minds of some as to whether there really exist two distinct species. It may be pointed out here that the cultures studied by Zuck, when grown in our laboratory under the conditions of those illustrated in plate III, fall into one or the other of the two general growth patterns illustrated in plate III and also have the corresponding microscopic characters of the two species. The two types of spores (pl. IID, E) do not occur in cultures in anything approaching the order of a 50–50 ratio, which would, if this character alone were employed, cause one to wonder with which species he was dealing. In making routine examinations of stock cultures of the two species, the alternate or atypical spore is sometimes seen, but always in proportionately such small numbers — a ratio perhaps of one to several hundred, or in one slide preparation (pl. IID, E) out of many — as to cause them to be disregarded in so far as species identifications are concerned.

In specimens from the field the two species are sometimes found growing side by side or in small intermixed patches on the same piece of cardboard or cotton fabric, their favorite habitats. If the substrate is favorable, as in the case of smooth cardboard, each species in the mixed infestation may be observed to be confined to its own circumscribed area with its growth not interlocking with that of its neighbor. Neither has been observed to receive any stimulation from proximity to other fungi under field conditions despite the fact that on a biotin-free synthetic medium, *Memnoniella* at least, and presumably *Stachybotrys* also, may receive tremendous stimulation from proximity to fungi which are autotrophic for biotin. It appears that there is no shortage of biotin under the conditions of storage and exposure of cotton fabrics, cardboard, and the like.

Still another point of similarity of behavior of the two species is that on the basis of preliminary and very limited data their period of viability appears to be shorter than that which is average for the common molds. One set of tests included 46 cultures of miscellaneous molds which had been preserved from 14 to 20 months on test tube agar slants under mineral oil and held for most of the period at 8° C. Outside of *Memnoniella* and *Stachybotrys* all were viable. In the former Fla. *B-32* was living and *B-66* dead, and in the latter Fla. *B-10* & *B-31* were alive while *C-1a*, *C-10*, & *C-11* failed to revive. Another series included 39 ordinary potato dextrose agar slants which had been alowed to dry down under room conditions and were then packed in a cardboard box on a laboratory shelf until they were four years old. Two cultures of *Memnoniella*, AMP *52*, *85* were in the lot and both were among the total of eleven that failed to revive when transferred to potato dextrose agar.

RELATION OF HYPHAE TO COTTON FIBERS

The histological relationship of the fungus and the cotton fiber was not studied beyond the purely exploratory phase. The results of the preliminary work were, however, so interesting and promising that in so far as *Memnoniella echinata* was employed for the work the results are recorded here for the sake of completeness, and with the thought that they might stimulate further effort along this line.

Fibers of a non-absorbent plugging cotton were immersed for ten minutes in 95% ethyl alcohol, washed thoroughly in sterile distilled water, then spread out singly on the surface of a mineral salts agar plus yeast extract in petri dishes. Inoculations were made by touching a loop suspension of spores of culture PQMD *82d* to the agar surface just at the side of the fiber. The dishes were placed at 30° C. for a day, then held under room conditions. Hyphae reached the fibers in from two to three days, growing over and under, but not penetrating until later when the advancing hyphal tips of the colony were well beyond the fiber. At from seven to nine days the colony had thickened somewhat to form a mat of hyphae about the fibers, at which point it appeared to be stimulated to produce a

few conidiophores. Removal and proper preparation of the fibers at this time showed the central canals to be filled with hyphae. Preparation for microscopic observation consisted of swelling the wall and of staining. This was accomplished by the well known method of immersion in 11% NaOH for three minutes, washing in water, immersing in 2% aqueous Congo Red for 10 minutes, washing again in water, and finally mounting in an 18% NaOH solution.

Action on the outer surface of the fiber appeared to be highly localized, direct penetrations of the wall occurring only at widely separated intervals. Once the lumen was reached growth was rapid and the canal was soon filled with hyphae (pl. IV). The action which destroyed the fiber appeared to be from the inside. Short sucker-like lateral branches from the main hyphae could be seen extending into dissolved-out pockets (pl. IVB, IC) sometimes growing out nearly to the cuticle, while the whole inner surface was severely corroded. At such a late stage, when there must have been little or no strength left in the fiber there was no evidence, either as corrosion or change in staining qualities, of any generalized action on the outer surface.

When the colony was allowed to grow long enough it soon covered the ends as well as the central part of the fiber. Even when this happened there appeared to be no more of a tendency for the hyphae to enter the exposed ends than to penetrate the wall directly.

The evidence then is that there is local and widely spaced penetration of the wall, that following penetration there is general and rapid development — in the lumen, and that loss in the substance and strength of the fiber is the result of generalized fungus action from within.

There are difficulties to be overcome in such a study but they are by no means insurmountable. When a fiber is penetrated at only one or two points there is little to hold the outside hyphae intact during the manipulation. This is further aggravated by the fact that the swelling of the fiber wall stretches the penetration tube and causes it to break. Hence the outside hypha is lost, taking with it the outer portion of the tube and the hypha which runs through the lumen is drawn away from the wall pulling out the inner portion of the tube. In a preparation like that of plate IVB the penetration hypha appears to have been broken within the fiber wall, with the two ends having been withdrawn nearly to the opening at either side. Except for the time factor involved, and the fact that the fiber was inoculated in such a way as to prevent end penetration, there is no way to be certain whether the hypha had grown in or out through the wall in such a preparation as pl. IVA.

PLATE IV. Cotton fibers 9 days after inoculation with *Memnoniella echinata*. A, Fiber with lumen filled with hyphae, inner surface of wall corroded by fungus action, and outer surface of wall intact, × approx. 170. B, Section of same enlarged to show more detail, × approx. 900. C, Camera lucida pencil sketch showing hyphae extending through the central canal and giving rise to systems of side branches which dissolve out pockets in the cellulosic wall, × 1425. For further details see text.

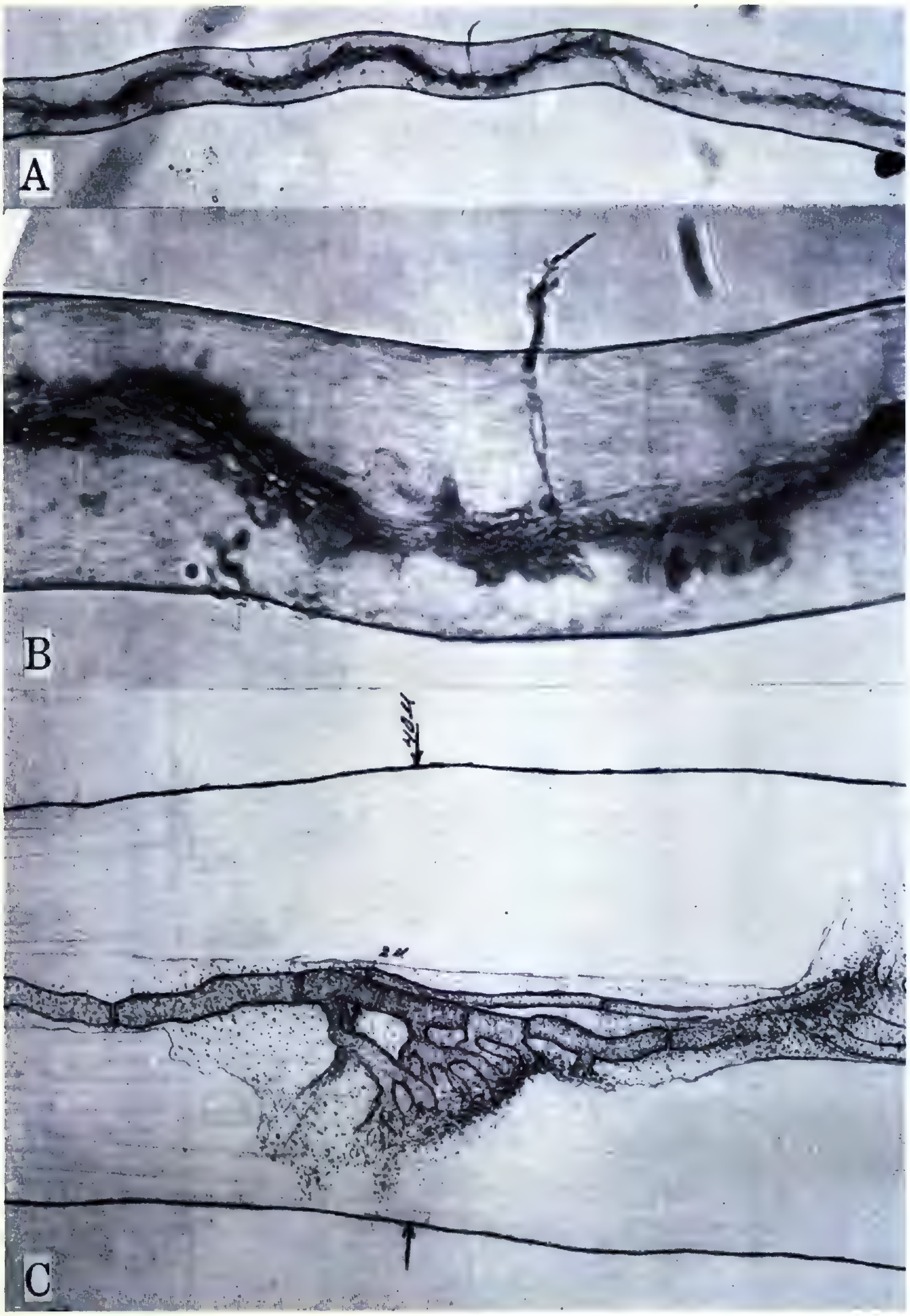

PLATE IV

Two other fungi, namely *Humicola* sp., PQMD *34e* and *Myrothecium verrucaria*, USDA *1331.1*, were tried with results similar to those described above.

DISTRIBUTION AND MATERIAL EXAMINED

To provide a basis for drawing conclusions as to the geographic distribution of *Memnoniella echinata*, types of material on which it grows, conditions under which it is active, organisms with which it is commonly associated, and its relative importance as compared with other fungi in the destruction of cellulosic materials, the following record is provided. Representative samples from the list have been placed on permanent deposit at the United States Department of Agriculture, and to a lesser extent at other institutions, where they will be available for future checking.

The samples are listed geographically in accordance with a scheme in use at the Cryptogamic Herbarium at Harvard University. Where more than one sample is listed for a geographic region, they are arranged chronologically as to collection date.

New York: Isol. from slime mold culture on moist unsterilized filter paper, Brooklyn College, 1947, *Laura A. Kolk*, Harvard *156*.

Pennsylvania: Isolated at Philadelphia Naval Shipyard in 1942 from salvage materials of unknown nature. — On unused grey cotton duck when received at Philadelphia Q. M. Depot, April 1947, from storage in an unknown region, PQMD *186*.

Maryland: Isolated at U.S.D.A., 1938, by *Harry Humfeld* from cotton duck (probably from test exposure in Florida) from the Wm. E. Hooper and Sons Co., Baltimore (USDA *1331.1*) ; see papers by Greathouse *et al* (12) (*Stachybotrys papyrogena*) and Zuck (37). On pieces of corrugated box taken from a cellar in Berwyn, Aug. 1947, comm. *Marsh*, PQMD *320b*, see pl. II, fig. F, G; fruiting on the same badly molded samples were, in order of prominence, *Stachybotrys atra*, *Memnoniella echinata*, *Gliomastix convoluta*, *Cladosporium herbarum*, *Scopulariopsis brevicaulis*, *Chaetomium globosum*, *Acrostalagmus cinnabarinus*, *Aspergillus* sp., etc.

North Carolina: on cloth bag in greenhouse, Raleigh, 12 Dec. 1946, comm. *Paul Marsh*, PQMD *209a*; bag used for soil shipment from unknown source; *M. echinata* most prominent, but *Stachybotrys* spores found in mounts and a very few sporodochia of *Myrothecium roridum* present. — On white cotton cloth (poplin) which became infested in laboratory test without inoculation, Cone Mills, Greensboro, spec. comm. *Marsh*, May 1947, PQMD *273a*; thoroughly mixed with *Gliomastix convoluta* and a few spores of the *Stachybotrys*-type were found.

Florida: Isol. at Univ. of Florida by *Geo. F. Weber* from Quartermaster cloth exposed experimentally, Fla. *B-32* — Ditto, canvas leggings, Fla. *B-66*. — Fruiting heavily on water-repellent khaki curtain hanging in temp.-humid chamber, Miami Marine Lab., cult. comm. *E. S. Reynolds* 30 July 1946, PQMD *183*. — On decorticated but not degummed ramie stalks in process of drying, Zellwood, July 1947, *J. D. Rebstock*. — Just above ground level on base of dead banana leaf, Key West, Dec. 1947, *W. L. White*, *PQMD 351*. — On moist under surface of an old cardboard box, Key West, Dec. 1947, *W. L. White*, *PQMD 368*. — On similar substrate, Key West, Dec. 1947, *W. L. White*, PQMD *369b*; occupying areas that were mixed with similar areas of another fungus, possibly *Stachybotrys papyrogena*.

Ohio: On paper excelsior used in shipment from San Francisco, exposed outdoors at Dayton for 1 mo., Aug. 1946, *C. C. Yeager*, PQMD *184*.

Indiana: Isol. from untreated cotton duck, Jeffersonville Quartermaster Depot, Aug. 1944, PQMD *177*. — In soil in J.Q.M.D. greenhouse, fide Martin.

Tennessee: Isol. at U. S. Dept Agr., by Humfeld, from a sample of cotton picked three days after opening at Knoxville, comm. *Marsh* (USDA *1229.2*).

Iowa: Isolated at Ames from 2 samples of parsley seed grown in California, April 1948, *Frances Meehan*, PQMD *487*, *488*.

Costa Rica: On ginger leaves collected by *Slosum*, Thaxter collection *615* as *Haplographium* sp. (Farlow Herbarium), spec. consisting of dried-down agar colonies only.

Panama: On grey cotton duck, December 1944, *E. S. Barghoorn*, PQMD *123j*; two small sporulating colonies on a small sample along with *Leptosphaeria* sp., *Tetracoccosporium* sp., *Pyrenochaeta* sp.; isol. from sample were *Cephaloporium* sp., *Brachysporium* sp., *Curvularia lanata*, *Fusarium Solani*, *Cladosporium herbarum*, *Trichoderma viride*, con. stage of *Hypoxylon*.

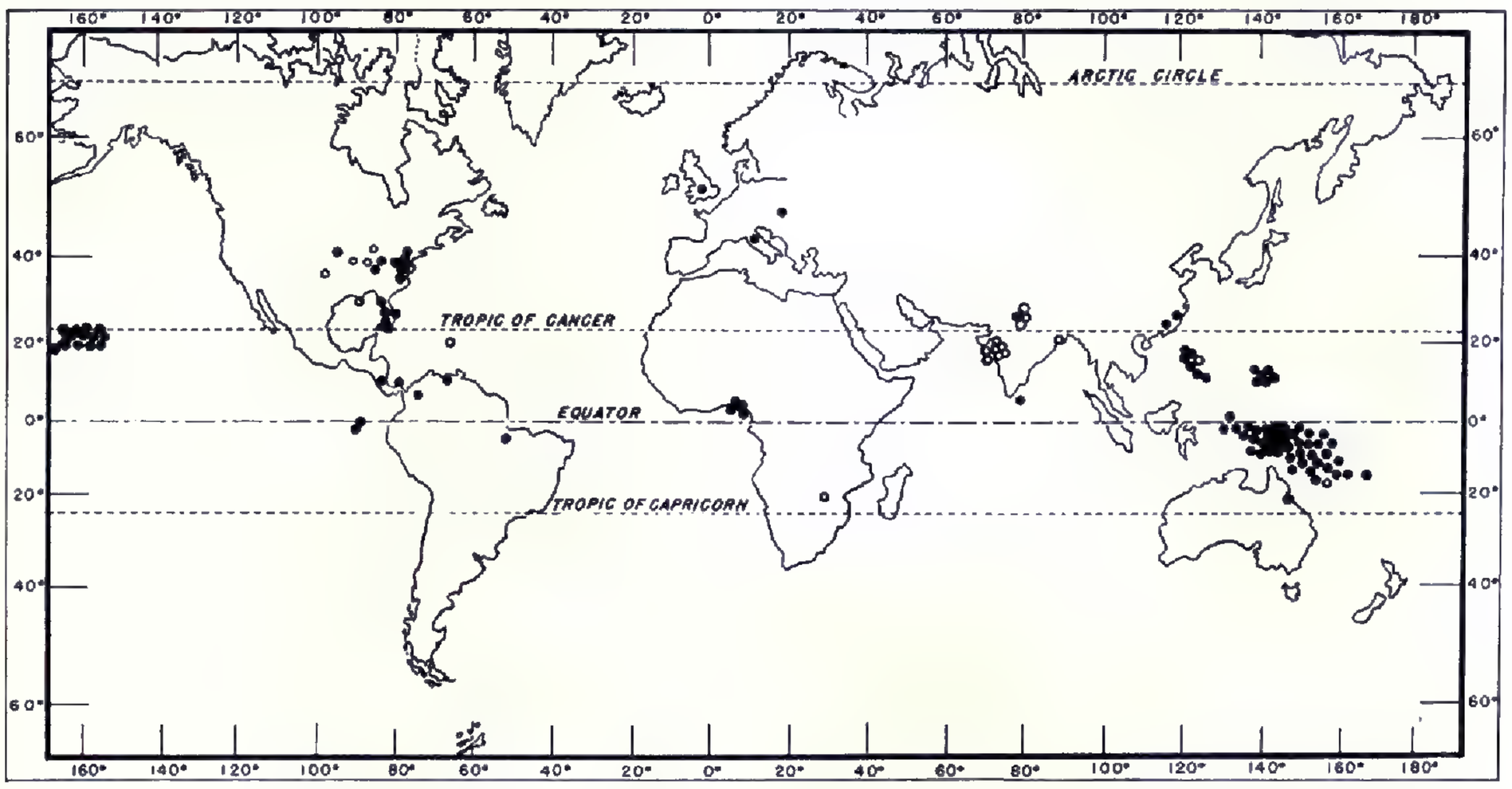

Fig. 1. Known geographic distribution of *Memnoniella echinata*. Solid dots indicate isolates or collections that have been seen and confirmed by the writers; circles indicate unconfirmed, though probably accurate, literature reports.

Colombia: On orchid intercepted at Hoboken, N. J., 13 August 1941, *D. P. Limber*, Hoboken *2076*, as *Stachybotrys* sp., (Herb. U.S.D.A.), with *Colletotrichum* sp.

Venezuela: On leaf of *Cattleya* sp., intercepted at Hoboken, N. J., 17 May 1945, *H. L. Sanford*, Hoboken *4375* (Herb. U.S.D.A.)

Brazil: On leaf of *Cattleya* sp., intercepted at Hoboken, N. J., 1 July 1941, *D. P. Limber*, Hoboken *1882*, (Herb. U.S.D.A.), with *Colletotrichum* sp.

Galapagos Islands: Cult. from dead stems of cactus, S. Seymour Isl., *G. W. Martin* (*6289*). — Cult. from litter, S. Seym. Isl., *G. W. Martin*, PQMD *242*.

Austria: "Auf Baumwollgarnfäden in Wien, . . . ," *type* slide of *Memnoniella aterrima* (Farlow Herb.).

England: Based on report by Galloway (10). Culture available but not examined.

China: on *Zingiber officinale* intercepted at Buffalo, N. Y., 14 September 1933, *W. T. Owrey*, as near *Stachybotrys papyrogena* (Herb. U.S.D.A.). — On *Zingiber officinale* intercepted at San Francisco, 2 Sept. 1941, *A. S. Johnson*, San Fr. *17796*, as *Haplographium* sp. (Herb. U.S.D.A.).

India: Isol. at New Delhi from deteriorated fabric (presumably deteriorated in India), cult., comm. *Dastur*, Apr. 1946, PQMD *176*. — See ref. 1.

Ceylon: "On Ceylon straw in laboratory" at Harvard University winter of 1892–93, as *Haplographium echinatum*, *Thaxter 634,635* (Farlow Herb.); spec. agar cult. only; data ambiguous.

Nigeria: Fruiting in many spots on under surface of grey canvas after 4 months in jungle exposure 4 ft. above ground, most abundant in vicinity of wooden supports, Port Harcourt, 12 Apr. 1946, *W. L. White*, Nigeria *1*; only organism present in sporulating condition. — From another sample, otherwise same data, Nigeria *2* — On cardboard boxes in open wooden crates in outside storage, U. S. Army warehouse and storage yard, Lagos, 18 April 1946, *W. L. White*, Nigeria *16*, sporulating extensively in pure stands on all surfaces and between layers of corrugated cardboard. — On U. S. Army service gas mask covers in wooden carton in warehouse, Lagos, 18 Apr. 1946, *W. L. White*, Nigeria *19a*, general throughout carton on both duck & webbing, assoc. with a scanty development of *Chaetomium* sp.

Australia: Isol. from canvas from Townsville by *H. L. Jensen*, Aust. Myc. Panel *52*.

Territory of Hawaii: Isol. at P.Q.M.D., Oct. 1944, *E. T. Reese*, Manila tent line, Fort Armstrong, PQMD *50d*, dominant on sample, assoc. with *Stachybotrys atra*. Isol. but not seen on spec.: *Asperg. Tamarii*, *A. niger*, *Fusarium Scirpi* var. *longipes*, & *Paecilomyces Varioti*. — Isol. at P.Q.M.D., Oct. 1944, *E. T. Reese*, tentage, Fort Armstrong, PQMD *51a;* fruiting profusely over a 20 x 12 in. sample, assoc. with *Gliomastix convoluta*; fungi isol. but not seen on material; *Penicillium chrysogenum*, *Aspergillus niger*, *Fusarium* sp., *Aspergillus ustus*, *A. Tamarii*. — On old cardboard box lying in grass in sun, Hickam Field, Honolulu, 9 Jan. 1946, *W. L. White*, Oahu *19a*, associated with *Stachybotrys atra*. — As foregoing but another box, *Oahu 22b*, also assoc. with *S. atra*. — On underside of mattress on ground in outside storage lot, Barber's Point Naval Storage Field, 10 Jan. '46, *W. L. White*, Oahu *23*, assoc. with *S. atra* & other Dematiaceae; *M. echinata* dominant and widespread through interior of mattress. — On old cardboard box on ground in sun, Barber's Point Naval Storage Field, 10 Jan. 1946, *W. L. White*, Oahu *24a*, widespread and dominant, assoc. with *S. atra*. — on under surface of cardboard box on ground, Barber's Point Naval Storage Field, 10 Jan. 1946, *W. L. White*, Oahu *25d*, small amount present among scattered patches of *Ascotricha*, *Penicillium* and *Helminthosporium*. — On grey canvas weighted container bag of an SPW3 plane in outside storage, Barber's Point Naval Storage Field, 10 Jan. 1946, *W. L. White*, Oahu *26b*, assoc. with *Alternaria* sp. which is dominant. — On canvas boot over turtle back collapsing mechanism of same plane, Oahu *27a*, assoc. with *Alternaria* sp. and *Cladosporium* sp. — On small white cardboard box on ground, Wuonae Mts., 13 Jan. 1946, *W. L. White*, Oahu *41a*, assoc. with *Cladosporium* sp. and *Stemphylium* sp. none of which were extensive. — On mattresses returned from S. W. Pacific area, 51st Quartermaster Base Depot, Honolulu, 14 January 1946, *W. L. White*, Oahu *43*, very extensive on and in a lot of mattresses returned from forward area, sent to salvage, and in process of reshipment to Manila at time of inspection, presumably having become damp in transit. — On white mattress cover in same lot with the above, Oahu *44*, growth extensive, assoc. with several other Dematiaceae, moist at time of inspection. — On and in pillow with above lot of material, Oahu *45*, extensive in pure stand.

Guam: On and in small cardboard boxes of photographic supplies contained in wooden crates in army warehouse, 4 Mar. 1946, *W. L. White*, Guam *3b*, scattered and associated with *Ascotricha chartarum*, *A.* sp., *Chaetomium* sp., & *Gliomastix convoluta*, the last being most prominent and widespread; the material obviously had become moist at some time before storage. — On grey canvas of folding cot in outdoor storage under tarpaulin, Q.M. Depot, 5 Mar. 1946, *W. L. White*, Guam *4*, occurring in numerous more or less delimited spots assoc. with non-sporulating Dematiaceae. — Another cot from same storage, Guam *5a*, occurring in numerous spots and mixed with *Gliomastix convoluta*. — On top side of white cloth bailing of Chem. Warf. protective clothing in tent storage under roof leak, Q.M. Depot, 5 Mar. 1946, *W. L. White*, Guam

11a, with *Ascotricha* sp., *Chaetomium* sp., & *Gliomastix convoluta; M. echinata* much the most prominent.

Saipan: On grey canvas army folding cot under tarpaulin in outside storage, Q.M. Depot, 7 Mar. 1946, *W. L. White*, Saipan *2a*, extensive spotting more or less mixed with *Chaetomium* sp. and a few sporodochia of *Myrothecium roridum* found. — On another cot from same storage, Saipan *3a*; *Memnoniella* spotting general & extensive, along with perithecia of *Nectria* sp.

Luzon (Manila area): On white unissued mattress cover brought in as salvage, in warehouse, Q.M. Depot 17, Zambulin, 26 Feb. 1946, *W. L. White & C. C. Yeager*, Manila *1a*, very extensive stand mixed with *Gliomastix convoluta*. — On cotton lining of asbestos glove with salvage material as in preceding citation, Manila *3*, numerous spots, other fungi not present in sporulating condition. — On winter o.d. army cap in salvage, Q.M. Depot 17, Zambulin, 26 Feb. '46, *W. L. White & C. C. Yeager*, Manila *4a*, nearly covering cotton parts in pure stand; not on wool though the latter was in a disintegrated powdery condition, a few *Ascotricha* perithecia found on the cotton. — On water repellent o.d. barracks bag, unused, otherwise as for preceding citation, Manila *7a*, growth scattered, extensive, a few perithecia of *Ascotricha* present.

Leyte (Tacloban): In pile of moist cardboard on sand beach, 28 Feb. 1946, *W. L. White*, Leyte *3a*, very extensive but not heavy, assoc. with *Gliomastix convoluta* and traces of *Curvularia* sp., *Myrothecium roridum*, and *Tetracoccosporium* sp. — On cardboard box on shelf in open side warehouse where rain had blown in, Q.M. Service Center I, Monument Beach, 28 Feb. 1946, *W. L. White*, Leyte *6a*, fruiting extensively along with *Chaetomium* sp., *Gliomastix convoluta*, & *Stachybotrys atra*.

New Guinea: Isol. from canvas, *G. C. Wade*, Australia, Aust. Myc. Panel *2*. — Isol. at J.Q.M.D., 1944, from Japanese tarpaulin from Hollandia, JQMD *309*. — Isol. at J.Q.M.D. from Japanese blanket from Hollandia, J.Q.M.D. 389. — Isol. at J.Q.M.D. from Japanese socks from Hollandia, JQMD, *421*. — Cult. from Japanese raincoat from Hollandia, JQMD *534*. — Isol. from tent fly from Port Moresby, JQMD *723*. — On canvas shoulder field bag from New Guinea, PQMD *31*, prominent on sample but not isol.; an *Aspergillus* generally distributed; isol. were *Botryodiplodia Theobromae*, *Aspergillus Sydowii* and two *Penicillia*. — Isol. at P.Q.M.D., 18 Oct. 1944, *E. T. Reese*, leather scabbard, PQMD *72i*; not sporulating on sample; surface dirty, possibly from ground; spores of many fungi but none identifiable as *Memnoniella*. — Isol. at P.Q.M.D., 25 Oct. 1944, *E. T. Reese*, unused canvas haversack, Finschafen, PQMD *82d*; white mycelium general on sample; *M. echinata* on 2 or 3 spots; isol. but not observable on sample: *Aspergillus glaucus*, *A. Oryzae*, *A. niger*, *A. terreus*, *Penicillium* sp., *Paecilomyces Varioti*, *Syncephalastrum racemosum*. — Isol. at P.Q.M.D., 25 Oct. 1944, *E. T. Reese*, canvas tentage, Finschafen, PQMD *84e*; a sample 4 x 3 in. with *M. echinata* sporulating on a spot less than 1 cm. diam. and probably *Aspergillus terreus* associated with the sewing; isol. but not seen on sample: *A. terreus*, *Penicillium citrinum*, *Pen.* sp. — Isol. at P.Q.M.D., 17 Nov. 1944, *E. T. Reese*, cotton rope, Finschafen, PQMD *87f*, not seen on sample; *Penicillia* or *Aspergilli* present in poor condition; isol.: *Penicillium citrinum*, *Aspergillus* sp. — Isol. at P.Q.M.D., 17 Nov. 1944, *E. T. Reese*, rope (hemp?), Finschafen, PQMD *88d*; spec. dusty, no mold found; isol.: *Aspergillus fumigatus*, *Fusarium diversisporum*. — Isol. at P.Q.M.D., 17 Nov. 1944, *E. T. Reese*, canvas leggings, Finschafen, PQMD *89e*; black spots general, mostly *Gliomastix convoluta* with here and there *M. echinata*; isol.: *Acremonium* sp.?, *Aspergillus ustus*, *Sporotrichum* sp., *Penicillium* sp. — Isol. at P.Q.M.D., 17 Nov. 1944, *E. T. Reese*, cotton khaki trousers, Finschafen, PQMD *90b*; undet. dark Hyphomycete scattered generally over sample but *M. echinata* not found; isol.; *Penicillium citrinum*. — Isol. at PQMD, 17 Nov. 1944, *E. T. Reese*, resin coated cloth, Finschafen, PQMD *91b*; white mycelium present but nothing identifiable as *M. echinata*; isol.: *Aspergillus flavus*, *A. terreus*, *A.* sp. — Isol. at P.Q.M.D., 17 Nov. 1944, *E. T. Reese*, canvas knapsack, Finschafen, PQMD *92i*; surface dirty and worn, mold doubtful; isol.: *Aspergillus niger*, *A. unguis*, *Cladosporium herbarum*, *Oedocephalum albidum*, *Penicil-*

lium spp. — Isol. at P.Q.M.D., 27 Nov. 1944, *E. T. Reese*, tarpaulin, Finschafen, PQMD *93f*; a small piece of material evidently in contact with ground; conspicuous organism is an old *Coniophora* or *Merulius*; isol.: *Curvularia brachyspora, Chaetomium funicolum, Penicillium funiculosum* series, *P.* sp., Ster. myc. — Isol. at P.Q.M.D., Nov. 1944, *E. T. Reese*, cotton twill trousers, Finschafen, PQMD *101b*; fairly bright and clean; no mold found; isol.: *Aspergillus terreus, Cephalosporium* sp., *Chaetomium globosum, Stachybotrys atra.* — Isol. at P.Q.M.D., 29 Nov. 1944, *E. T. Reese*, canvas & leather helmet liner, Finschafen, PQMD *102b*; in molded condition but these not identifiable on specimen; isol.: *Aspergillus japonicus, A. unguis, Penicillium chrysogenum, P.* sp., *Trichothecium roseum, Stachybotrys atra.* — Isol. at P.Q.M.D., 29 Nov. 1944, heavy web cartridge belt, Finschafen, PQMD *105b*; *M. echinata* sporulation general, superf. white myc. present; isol.: *Penicillium sp.* — Isol. at P.Q.M.D., 29 Nov. 1944, *E. T. Reese*, canvas legging, Finschafen, PQMD *106e*; spec. showing effects of wear; white myc., possibly Basidiomycetous, general; small amt. *M. echinata* sporulation in scattered spots assoc. with *Gliomastix convoluta*, isol.: *Aspergillus niger, Fusarium* sect. Elegans, *Cladosporium herbarum, Penicillium citrinum* series, *Phoma* sp. — On cotton khaki trousers, Finschafen, PQMD *107c*, mold scanty with *M. echinata* on khaki and *Gliomastix convoluta* on white lining; isol.: *Cephalosporium* and *Aspergillus.* — Isol. at P.Q.M.D., 28 Mar. 1945, *E. T. Reese*, leather glove (unwrapped) Finschafen, PQMD *135a*; spec. stiff, hard, dirty; no evidence that molds isol. were other than extraneous deposits; isol.: *Aspergillus flavus, Penicillium* sp., *Pullularia pullulans.* — Isol. at P.Q.M.D., 28 Mar. 1945, *E. T. Reese*, canvas legging (unwrapped), Finschafen, PQMD *136b*; no fungi observable on sample; isol.: *Aspergillus niger, A. terreus, Humicola* sp. — Isol. at P.Q.M.D., 28 Mar. 1945, *E. T. Reese*, worn leather shoes, Finschafen, PQMD *138b*; much green mold, no *M. echinata* found; isol.: *Aspergillus flavus, A. niger, A. terreus, Chaetomium* sp., *Penicillium chrysogenum, P.* sp. — On white cotton bag holding metal aircraft parts in wooden crate in discarded outdoor supply dump. Lae, 10 Feb. 1946, *W. L. White & C. C. Yeager*, Lae *11*, sporulating over much of surface, much decay. — On cardboard box, otherwise data as for preceding, Lae *13c*; this, *Stachybotrys atra* and an *Aspergillus* generally distributed, more or less mixed but mostly on distinct areas. — On old collapsed cardboard box on ground, other data same as for preceding, Lae *19a*, not heavy but in numerous scattered patches, assoc. with *Aspergillus* sp., *Gliomastix convoluta*, and *Stachybotrys atra.* — On Lister water bag (plastic impregnated cloth, new but in salvage, Q.M. Salvage Depot, Finschafen, 13 Feb. 1946, *W. L. White*, Finch *6a*, fruiting in 3 spots, each 2–4 in. diam., assoc. with *Tritirachium* sp. — On cloth and buttons of army cotton shirt, Q.M. Salvage Warehouse, Finschafen, 12 Feb. 1946, *W. L. White*, Finch *7a*, assoc. with *Chaetomium* sp.; material had become damp in transit. — On inner layers of an old dry cardboard box, Finschafen, 14 Feb. 1946, Finch *11a*, assoc. with *Gliocladium atrum, Tritirachium* sp., undet. sp. — On underside cardboard box of nails on ground, Finschafen, 16 Feb. 1946, *W. L. White*, Finch *14*.

Biak Island: On tarpaulin covering machinery in outside storage, 20 Feb. 1946, *W. L. White*, Biak *10*, extensive pure stand.

New Georgia: Isol. at P.Q.M.D., 9 Feb. 1945, *E. T. Reese*, tarpaulin, PQMD *127c*; sample badly molded but *M. echinata* not identifiable as such; isol.: *Cephalosporium* sp., *Fusarium Solani* var. *minus, F.* sect. Elegans, *Phoma* sp. — Isol. at P.Q.M.D., 5 Feb.

PLATE V. *Memnoniella echinata* on white cotton mattress cover. Taken from a Quartermaster salvage warehouse in Manila where great quantities of similar items and clothing were being sorted out after having been collected from various places. The species was of common occurrence in the material. This cover was folded, unused, but had gotten wet at some time, at least around the marginal creases. A very small amount of *Ascotricha* and *Gliomastix convoluta* also present but none in the area of the photograph. (By Photographic Department, Philadelphia Quartermaster Depot, × 1).

PLATE V

1945, *E. T. Reese*, canvas haversack, PQMD *131c*; well molded; fruiting organisms were *Orbilia*, *Nectria*, *Dendryphium* sp.; no *M. echinata* found; isol.: *Penicillium chrysogenum*, *P.* sp., *Trichoderma viride*. — Isol. at P.Q.M.D., 9 Feb. 1945, *E. T. Reese*, canvas haversack, PQMD *134a*; spec. generally spotted with dark mold one of which was a *Chaetomium*; no evidence of *M. echinata*; isol.: *Aspergillus fumigatus*, *A. niger*, *A. flavus*, *A. Sydowi*, *Chaetomium globosum*, *C. indicum*, *Stachybotrys atra*. — Isol. at P.Q.M.D., 28 Mar. 1945, *E. T. Reese*, top of pyramidal tent exposed 7 mo., PQMD *147d*; sample collected for a conspicuous Basidiomycetous mycelium; an undet. black Hyphomycete also found; isol.: *Aspergillus versicolor*, *Penicillium* sp., *Stemphylium consortiale*, *Verticillium* sp. — Isol. at P.Q.M.D., 28 Mar. 1945, *E. T. Reese*, tent top exposed in sun 6 mo., PQMD *149a*; only species seen was *Orbilia* sp.; isol.: *Coprinus* sp.?, *Fusarium* sp., *Phoma* sp., sterile myc. — Isol. at P.Q.M.D., 28 Mar. 1945, *E. T. Reese*, canvas shelter half, PQMD *155d*; badly molded, but *M. echinata* not fruiting; *Myrothecium roridum* present; isol.: *Aspergillus niger*, *Chaetomium funicolum*, undet. sp. — Isol. at P.Q.M.D., 28 Mar. 1945, *E. T. Reese*, cotton barracks bag, PQMD *156e*; badly molded by an undet. black Hyphomycete; no *M. echinata* found; isol.: *Aspergillus flavus*, *Chaetomium funicolum*, *C. indicum*, *Penicillium* sp. — Isol. at P.Q.M.D., 28 Mar. 1945, *E. T. Reese*, heavy cotton web pistol belt, damp, hanging in tent, PQMD *157b*; heavily molded by *M. echinata* only; isol.: *Scopulariopsis brevicaulis*.

Bougainville Island: Isol. at Harvard Univ. June–July 1944, W. H. Weston, Jr., from tent canvas, PQMD *1c*.

Guadalcanal: Isol. at J.Q.M.D. from shoe leather, JQMD *794*. — Isol. at J.Q.M.D. from mattress cover, JQMD *1020*. — Ditto, JQMD *1043*.

Locality unknown: "From gross culture of banana skins," April 1934, *D. H. Linder* (Farlow Herb.). — Isol. from canvas, *H. L. Jensen*, Aust. Myc. Panel *85*. — Isol. from canvas, *H. L. Jensen*, Aust. Myc. Panel *86*.

DISCUSSION

From the data presented several generalizations may be made.

It is evident that *Memnoniella echinata* is a tropical species. It flourishes best in rain forests and regions of high humidity within 25 degrees of the equator. This is indicated by the instances of occurrence which came to notice during the war, and it is equally evident from an examination of less extensive pre-war literature records and herbarium specimens. Occurrence in temperate regions is sporadic and there is as yet no evidence that the species is established in such regions as Central and Northern United States, England, or Central Europe. It would be of interest to determine experimentally whether the spores are capable of overwintering in the out-of-doors in the Northern United States. The map in Fig. 1 is not to be interpreted too specifically. It will be readily understood that an organism occurring on the types of materials cited might be picked up in any part of the world as these materials are transported over the earth's surface. It seems probable that the species is even more predominantly tropical than a glance at the map would indicate. Observation in the tropics has demonstrated beyond all doubt that materials become infested after being transported to those regions and that the organism grows and flourishes and forms extensive and conspicuous black growths on the materials while they are in those regions. On the other hand the writers in only three or four instances have actually seen the fungus in sporulating

condition north of Florida. Even these infestations were in basements, greenhouses or other warm places. Other instances of occurrence are based largely on chance isolations around laboratories where materials were being brought in from regions further south. The two Iowa isolates, for example, perhaps would be more accurately cited as having come from the milder climate of California.

If the distributional data for *Stachybotrys atra* (which, incidentally, have already been assembled) were mapped as in Fig. 1, they would show that species to be fundamentally north temperate in its distribution, with a thinning out toward the tropics. The two species, i.e., *Memnoniella echinata* and *Stachybotrys atra*, are distinct, however, regardless of geography.

Memnoniella echinata is cellulose-loving. As it occurs in nature its preferences appear to be for the purest forms of cellulose, i.e., cotton materials and paper. Even the incidence of its occurrence on plant debris such as leaves, stems, etc., is not great considering the amount of collecting that has been done for fungi on such materials. In no instance has it been found sporulating on wood, plastics, leather, paint, wool, or other such materials, despite the extensive studies that were made during the war on the microbiological deterioration of such materials.

While *Memnoniella echinata* has sometimes been observed growing on tents and tarpaulins that have been erected in the field, it is doubtful if the species plays an important part in the early phases of the deterioration of such items. Even in the later stages of disintegration it is less prominent on such items than it is on certain other types of materials. Its damage is primarily to untreated fabrics in transit and storage, especially if such materials are allowed to become moist from rain. The organism thrives best in moist, dark habitats where air circulation is limited but not cut off completely. To illustrate by two specific examples, on Guam it was found growing extensively on grey canvas cots stored outdoors and covered with tarpaulins but was not on the tarpaulins, and in the same area it was found on grey medium weight fabrics stored in a leaking tent but was not among the several species of fungi that were growing and fruiting generally over the inner surface of the roof and on the sidewalls of the tent itself. One habitat in which it may always be found around army installations in the tropics is on corrugated cardboard cartons that are or have been in contact with the ground or have been held for periods in outside storage and have gotten wet. In such cases the black mold develops extensively on the bottom of the box, or between the layers of cardboard, or on cellulosic materials within the carton.

On the basis of direct examination *Memnoniella echinata* has been observed on paper and fabric materials in the tropics more frequently than any other single species. The fungi most frequently seen associated with it are, first *Gliomastix convoluta* and second *Stachybotrys atra*. The perithecia of species of *Ascotricha* and *Chaetomium* are also fairly frequent. In isolation procedures, unless special care is used, these cellulose-destroyers may become lost among miscellaneous *Penicillia* and *Aspergilli*

which may or may not be important in the deterioration process. In making isolations from such materials the black *Aspergilli* and *A. terreus* have appeared frequently on the agar but they are not often seen in sporulating condition on the molded items from which the isolations are made. There is no evidence that under field conditions any one of these organisms contribute anything toward the development of any other. Where *Memnoniella* is present on the material it usually is dominant.

LITERATURE CITED

1. **Anonymous.** A preliminary list of micro-organisms which cause damage to Ordinance stores in India, with particular reference to tentage and cordage. Controller General of Inspection Technical Report No. Bio/45/5: 418–425, *tab. 1–3, fig. 1–2, 1 graph page*. 1945.
2. ————. Cultures of fungi obtained from deteriorated materials, chiefly from New Guinea, and maintained by the Mycological Panel, Scientific Liaison Bureau, p. [1]–8. Commonwealth of Australia, Scientific Liaison Bureau. (Mimeographed). Undated.
3. **Barghoorn, Elso S.** Studies of the deterioration of textiles under tropical conditions in the Canal Zone. Office of Scientfic Research and Development Report *4807*: 1–60, *fig. 1–51, tab. 1–9*. (U. S. Gov't., Mimeographed). 1945.
4. **Bisby, G. R.** Stachybotrys. Brit. Myc. Soc. Trans. **26:** 133–143, *fig. 1–9*. 1943.
5. ————. Stachybotrys and Memnoniella. Brit. Myc. Soc. Trans. **28:** 11–12. 1945.
6. **Brian, P. W. & Hemming, H. G.** Production of antifungal and antibacterial substances from fungi; preliminary examination of 166 strains of Fungi Imperfecti. Journ. Gen. Microbiology **1:** 158–167, *tab. 1*. 1947.
7. **Brien, R. M. & Dingley, Joan M.** Rot-proofing of canvas. New Zealand Journ. Sci. & Technol., B, Gen. Sect. 27: 133–138, *fig. 1, tab. 1–5*. 1945.
8. **Clements, Frederic E. & Shear, Cornelius L.** The genera of fungi, 1–496, *pl. 1–58*. (H. W. Wilson Co., New York). 1931.
9. **Ferraris, T.** Haplographium echinatum. *In* Fl. Ital. Cryptog., part I, fascile 8, p. 277. 1912.
10. **Galloway, L. D.** Note on an unusual mould fungus. Brit. Myc. Soc. Trans. **18:** 163–166, *fig. 1–2*. 1933.
11. **Graff, Paul Weidemeyer.** Philippine Micromycetous Fungi. Torrey Bot. Club Memoirs **17:** 56–73. 1918.
12. **Greathouse, Glen A., Klemme, Dorothea E., & Barker, H. D.** Determining the Deterioration of cellulose caused by fungi. Indust. & Eng. Chem., An. Ed. **14:** 614–620, *fig. 1–8*. 1942.
13. **Höhnel, Franz von.** Memnoniella Höhn. n. g. Centralbl. Bakt. 2: **60:** 16–17. 1923.
14. **Klemme, Dorothea, Greathouse, Glenn A., Bollenbacker, Katharina, & Pope, Seth.** The deterioration of cotton fabric by certain microorganisms. U. S. Dept. Agr. Cir. 737: 1–11, *fig. 1–5, tab. 1*. 1945.
15. **Langeron, M.** Précis de mycologie, 674 pp. (Paris). 1945.
16. **Lindau, G.** Haplographium echinatum. *In* Rabenh., Krypt.-Fl. 1: **7:** 697. 1906.
17. **McBeth, I. G. & Scales, F. M.** The destruction of cellulose by bacteria and filamentous fungi. U. S. Dept. Agr., Bureau Pl. Ind. Bull. 266: 1–50, *tab. 1–6, pl. 1–4*. 1913.
18. **Magee, C. J., Hansen, C. T., & Kerr Grant, C.** Report on the condition of service material under tropical conditions in New Guinea, (1)–92, *fig. 1–152*, 1st ed. (Scientific Bureau, Melbourne). Oct. 1943.

19. **Marsh, Paul B. & Bollenbacker, Katharina.** The vitamin requirements of Memnoniella and Stachybotrys. Amer. Journ. Bot. **33:** 245–249, *fig. 1–3, tab. 1–.4* 1946.
20. **Martin, G. W.** Project report for 21 October 1944. Project R–550–42. Jeffersonville (Indiana) Quartermaster Depot. (Typewritten).
21. ————. Additions to Galapagos fungi. Pacif. Sci. **2:** 71–77. *fig. 1–2.* 1948.
22. **Perlman, D.** The nutrition of Memnoniella echinata. Amer. Journ. Bot. **33:** 831. (Abstract). 1946.
23. ————. On the nutrition of Memnoniella echinata and Stachybotrys atra. Amer. Journ. Bot. **35:** 36–41, tab. 1–7. 1948.
24. **Rivolta, S.** Dei Parassiti Vegetali, p. 1–592, *pl. 1–10.* (Torino, Italy), 1873; ed. 2. 1884.
25. **Romano, Frank R.** Spore-rain technique for mildew resistence testing. Amer. Dyest. Reporter **36:** 651–653, 675, *fig. 1–3.* 1947.
26. **Saccardo, P. A.** Haplographium echinatum. *In* Syll. fung. **4:** 307. 1886.
27. **Scheffer, T. C. & Duncan, Catherine G.** Fungistatic vapors for control of mold in packages and equipment. Industr. and Eng. chem. **38:** 619–621. 1946.
28. **Seaver, Fred J. & Chardon, Carlos E.** Haplographium. *In* Sci. Surv. Porto Rico & Virgin Islands **3:** 98. (N. Y. Acad. Sci.). 1926.
29. ————, ————, **& Toro, Rafael A.** Supplement to Mycology. Sci. Surv. Porto Rico & Virgin Islands **8:** 209–225. (N. Y. Acad. Sci.). 1932.
30. **Stevenson, John A.** A check list of Porto Rican fungi and a host index. Journ. Dept. Agr. Porto Rico **2:** 125–264. 1918.
31. **Thom, Charles.** The Penicillia, 644 pp. (Williams and Wilkins Co.). 1930.
32. **Wakefield, E. M. & Bisby, R. G.** Memnoniella echinata (Rivolta) Galloway. *In* List of Hyphomycetes recorded for Britain. Brit. Myc. Soc. Trans. **25:** 74. 1941.
33. **Weston, William H.** Tropical fungus culture collection. Office of Scientific Research and Development Report 5681: 1–52. (U. S. Gov't. Mimeographed). 1945.
34. **White, W. Lawrence.** Mycological factors. *In* Report of Army Air Forces Tropical Science Mission, 25–46, *fig. 1–16.* (Wright Field, Ohio). 15 May 1946. (Revised as Topical Report 13 of the Biological Laboratories, Office of the Quartermaster General, Military Planning Division, Research and Development Branch, 1–44, *fig. 1–29,* (mimeographed, 29 Nov. 1946).
35. ————. Deterioration of Quartermaster fabrics in the tropics. Quartermaster Review **26:** 16–17, 63–64, 67, *4 fig.* Nov.–Dec. 1946.
36. ————, **Darby, Richard T., Stecchert, Gladys M., & Sanderson, Kathryn.** Assay of cellulolytic activity of fungi isolated from fabrics and related materials exposed in the tropics. Mycologia **40:** 34–84, *fig. 1–3, tab. 1, 2.* 1948.
37. **Zuck, Robert K.** Isolates intermediate between Stachybotrys and Memnoniella. Mycologia **38:** 69–76, *fig. 1–2,* 1946.

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NOMINA CONSERVANDA PROPOSITA AND NOMINA CONFUSA — FUNGI

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1. NOMINA CONSERVANDA

> The principle which consists of being exact and of attributing to a predecessor only what he said, neither more nor less, ought to be a sufficient guide. — John Briquet.

Although for many years there has been a list of nomina generica conservanda proposita for the Fungi, the first fungus name has yet to be conserved. This suspension of judgment may in particular cases have resulted from uncertainty concerning the status of currently accepted names and their synonyms — uncertainty about the starting-points for valid nomenclature of various groups, the relative dates of important works, the definition of imperfect states, and other essential matters. When for one or more of these reasons it is impossible to know what names are available for a group, or whether a name is legitimate or not without conservation, it is difficult to act on proposals for conservation. A good deal of the suspension of judgment undoubtedly has been the result of inertia; but even so, it has probably prevented the official sanctioning of a number of blunders, and has to that extent been advantageous.

Not all of the uncertainty has been dispelled, but enough that critical consideration of many proposals is possible. The initiative in this work was taken by the Nomenclature Committee of the British Mycological Society, who have brought together and published a large amount of pertinent information (cited herein as BMS 1, 2, 3). Dr. M. A. Donk, Dr. G. R. Bisby, and Drs. R. Singer & A. H. Smith have contributed discussions of a considerable number of proposals, and other authors, detailed presentations of individual problems.

In the "References" at the end of this paper an attempt has been made to cite all proposals, or comments on proposals, for conserving generic names of Fungi. It would be overly optimistic to suppose such a list complete, and that pretension is not made; * since a search for proposals has been made over the last ten years, it is likely that the majority have been discovered and entered. In the pages that follow all have been discussed except those to conserve *Barya*, *Capnodium*, *Ceriospora*, *Cryptoderis*, *Cryptomela*, *Didymella*, *Dothiopsis*, *Massariella*, *Pactilia*, *Penzigia*, *Pisomyxa*, *Rhizopus*, and *Tromera* as listed in the "Supplementum" to the third edi-

* Two valuable papers by Donk arrived (IV.18.1949) while the present notes, completed for literature received through December of 1948, were in press; unfortunately they cannot be discussed here. They are (1) New and revised nomina generica conservanda proposed for Basidiomycetes (Fungi). Buitenzorg Bot. Gardens Bul. iii **18**: 83–168. 1949 and (2) Gyromitra Fr. versus Gyrocephalus Pers. (Fungi: Helvellaceae). Ibid. 169–170. 1949.

tion of the International Rules and *Ceriospora* and *Tromera* as presented by the B.M.S. committee (2 pp. 290, 283), and those incompletely presented, without discussion or nomina rejicienda, by Shear (no date).

Dr. G. W. Martin has written (in litt.), "Any proposals for conservation should do three things: (1) propose names that are clearly invalid according to the Rules; (2) have the facts stated in support of the proposal correct; (3) have the record complete." The first of these criteria clears away many obviously unnecessary proposals, like that to conserve *Agaricus* 1821 vs. *Psalliota* 1872; the third makes plain the inadequacy of most of the proposals, originally offered as bare statements of nomina conservanda and nomina rejicienda, without notes on the history and status of the names or on the case for conservation; the second underlines the need for further study not only of many of these briefly presented proposals but also of some expounded at greater length. Dr. G. R. Bisby has written (also in litt.), "A taxonomist should make every effort he conscientiously can to keep in use a name (of genus or species) that has many users, actual or potential." This is the essence of the argument for the provision (in Art. 21) for conservation. Both of these expositions of philosophy, and that of Briquet which heads this paper, have been followed to the best of the writer's ability in the present notes.

There are in general two procedures which may be adopted in considering nomina conservanda proposita. One may endeavor to learn how "many users, actual or potential," a name has — that is, its degree of currency —; and if it proves to have wide use in a particular application, to put together a case for its retention. Or one may endeavor to learn the status of a name, and the application (or applications) in which its use is permissible — that is, its availability — ; and if its use in an application for which it is available is prevented "by the strict application of the Rules of Nomenclature, and especially of the principle of priority," to determine whether "many users, actual or potential," would be benefited by its retention. The second procedure has been adopted in these notes, as permitting an economy of effort: it has seemed useless to determine the currency of a name in a particular application if, as is sometimes the case, the name should prove not available in that application.

The mechanism of conservation is provided by the International Rules of Botanical Nomenclature; and an attempt has been made to follow the Rules without aberration, including that Article (21) which sets forth the conditions under which conservation is permitted. The official edition of the Rules (entered in the "References" under Briquet, and cited throughout as IR), is now in some respects out of date, since it was amended at Amsterdam. The amendments adopted are set forth, directly or by reference to the "Red Book" (Synopsis of Proposals Concerning Nomenclature, etc.), in the first volume of the Proceedings of the Amsterdam Congress (cited herein wherever pertinent); the "principal decisions" were published also in Science ii **83**: 416–418. 1936; Jour. of Bot. **74**: 75–78. 1936; and Kew Bull. Misc. Inf. **1936**: 185–188. 1936. These amendments have

been incorporated in unofficial, but none the less useful, versions of the Rules published in 1945 by Bisby (cited as IRB) and in 1947 for the American Society of Plant Taxonomists (entered under Camp, et al., and cited as IRA). No attempt has been made to take account of any changes in the official third edition of the Rules other than those whose adoption is explicitly indicated by the Proceedings of the last Congress; the "Proposed Amendments" assembled and multigraphed by the American Society of Plant Taxonomists and the multigraphed "Supplement" to the Rules prepared by Sprague in 1948 (which, it is submitted, where it departs from the accepted text and amendments likewise has the status of a series of proposals) were in any case not available to the writer, nor to the botanical community in general, as late as September, 1948. Since it seems evident that alterations in the Rules will be adopted by the next Congress, it is strongly urged that decisions on nomina conservanda for Fungi made before the adjournment of that Congress be held subject to revision if the status of any name under consideration is, or would be, changed by authorized changes in the Rules.

Article 5 ("In the absence of a relevant rule, or where the consequences of rules are doubtful, established custom must be followed.") is sometimes cited in justification of egregious departures from the provisions of the Rules. It should be unnecessary to point out that the Article embodies a strict limitation of the principle of established custom. Article 4 ("The essential points in nomenclature are: (1) to aim at fixity of names . . .") is occasionally adduced to the same purpose. It should again be unnecessary to point out that to use a name *Quidlibet* for fungi of kind B although it was published by its author for fungi of kind A does not bring about "fixity of names," but only insures that the word *Quidlibet* shall be perpetuated as a name for something or other; * and that such misapplication violates the other "essential point" enumerated under Art. 4 ("(2) to avoid or reject the use of forms and names which may cause error or ambiguity or throw science into confusion"). A third truism is here offered: not all precedents are good precedents — not even all those supplied by Appendix III of the Rules.

Neither this nor any other set of notes on nomina conservanda is all-embracing or infallible; it is to be hoped that other mycologists will attempt further discussions, so that no proposal may be acted upon which has not been critically studied. Those who undertake such study will learn that a proposal that might have been written in two minutes and two lines may require ten hours of hard work and ten pages of heavy writing for its investigation and evaluation.

* "The first point of our nomenclature must still be to aim at fixity of names; and by what has become universal consent the correct way to do this is to trace each name to its origin. . . . The test that this has been done correctly is that whenever it is checked, the answer is always the same." — Mason, Naturalist (N. Eng.) **1948**: 7. 1948.

ACROTHECA FUCKEL vs. GOMPHINARIA PREUSS — IR p. 125; IRA p. 39.

The Fuckel citation as given, ll. cc., is inadequate and inaccurate; *Acrotheca* was published, in a paper entitled "Enumeratio Fungorum Nassoviae," in Nass. Ver. f. Naturk. Jahrb. **15**: 42. 1861. The citation of the type is erroneous; *Acrotheca* as published was monotypic, and its type must therefore inevitably be *A. Gei* Fuckel, Nass. Ver. f. Naturk. Jahrb. **15**: 43. 1861. The citation of the proposed type is erroneous in implication; the "*A. caulium* Sacc. Mich. I 75" was not in that place published in *Acrotheca* but as a "sp. nov." of the genus *Acrothecium* (Corda 1838); *Acrotheca caulium* is (Sacc.) Sacc., Syll. Fung. **4**: 276. 1886. The citation of the alleged emendation is erroneous; the proposal is to conserve "*Acrotheca* Fuck. . . . emend. Sacc. Mich. II (1880) 24"; but in the place cited Saccardo gives a short description of "*Acrotheca* Fuckel" and lists as examples the two species *A. Solani* (Sacc.) Sacc. and *A. Gei* Fuckel; since he does not for another six years so much as recognize *A. caulium* as a member of the genus, he cannot be said to have emended it in 1880 so as to make *A. caulium*, even for him, eligible for designation as type.

The only proposal which could be entertained here would be to conserve *Acrotheca* Fuckel 1861 — Type: *A. Gei* Fuckel — vs. *Gomphinaria* Preuss. Since there is no way of knowing whether such conservation would achieve the ends considered desirable by the author of the published proposal, it is desirable, or perhaps even necessary, to reject it and to dismiss the matter unless a new motion, in order, is offered.

ACROTHECIUM SACC. vs. CORDANA PREUSS and CACUMISPORIUM PREUSS — IR p. 126; IRA p. 39.

There is no such genus as the one proposed for conservation. *Acrothecium* is listed, ll. cc., as "Sacc. Mich. II (1880) 29." If that citation were correct, *Acrothecium* Sacc. would be a later homonym of *Acrothecium* (Corda) Lév., and if retained would have to be conserved against Léveillé's genus. But in point of fact there is no *Acrothecium* Sacc. 1880; what Saccardo describes, l.c., is "*Acrothecium* Corda." *Acrothecium* was published by Corda in Icon. Fung. **2**: 10. 1838 as *Trichothecium* subg. *Acrothecium* Corda, and was monotypic: "*Tr. Acroth. parasitans*" is the type. It was treated as a genus by Léveillé, Considerations Mycologiques p. 131. 1846 ("Extrait de" d'Orbigny, Dict. Univ. d'Hist. Nat. **8**: 494. 1847), and by Preuss in Linnaea **24**: 110. 1851. Though neither transferred *T. parasitans* to *Acrothecium*, as the type of the subgenus that species must be also the type of the genus.

The only proposal which could be entertained in this matter would be to conserve *Acrothecium* (Corda) Lév.. 1846 vs. *Cordana* Preuss and *Cacumisporium* Preuss 1851. If the three genera are actually synonymous, conservation of the earliest is unnecessary; if they are not, the proposal is impossible. It should be rejected.

The proposal to conserve "*Acrothecium* Sacc. 1880" implies the most

important principle at stake in the consideration of and action on nomina conservanda proposita. Parallel proposals appear elsewhere. The general situation, briefly, is this: A genus has been described for certain species. Another author has misapplied the name, adding to the genus species not congeneric with its type or, it may be, with any species included by the author of the genus. The misapplication of the name has gained a degree of currency. It is then proposed to postulate that the author who misapplied the earlier name actually published thereby a new genus, to attribute the genus to him as of the date when his error was published, and to conserve the name of the genus thus ex post facto erected against the validly published original name.

The argument for such an anomalous procedure is that the erring author has deluded others into following his error, and that a way should be found to make right that which is wrong, in order that those others may be afforded justification for persisting in error. The arguments against such a course are many, but they mostly boil down to a maxim enunciated by Briquet (Vme Congr. Int. Bot. Cambridge 1930 Rec. Synopt, vi.): "Le principe qui consiste à être exact et à ne faire dire à un prédécesseur que ce qu'il a dit, ni plus, ni moins, doit suffire comme guide conducteur." The sentence deserves to be printed, in the three languages of the Rules, at the head of all lists of nomenclatorial proposals. In the general situation under consideration the first author published a genus to embrace certain species. His diagnosis may have been at fault, or the species may have proved, under later examination, to be unrelated; but it is clear that he said, in effect, "I publish this genus for these species." However much redescription or redelimitation may be necessary, it is then accurate to attribute the genus to him. But the second author had no intention of publishing a new genus nor any idea that he was doing so. In fact, he did not do so; he merely listed under an earlier name (for which he correctly cited the author) species which later examination shows not to belong to that genus. To say that he published a new genus, and to write it genus *Quidlibet* Auct. II when Author II himself was writing (more or less competently) of *Quidlibet* Auct. I, is far from exact, and is making a predecessor (Author II) say much more than he ever actually said.

These are the conflicting principles. The practical results of the two courses of action are similar to those brought out in the discussion of Art. 54 at Amsterdam (Zesde Int. Bot. Congr. Amsterdam Proc. **1**: 347–354. 1936). There the question was whether a new combination should be attributed to the first author who published it, even though he misapplied the name, or to the first author who gave a correct circumscription of the species. Under the second alternative it would be necessary to attempt to study not only the type specimen of the original name, but also the specimens of those who had successively used the original epithet in combination, in order to discover which combinations were published with a "correct circumscription." And since opinions would vary concerning the correct circumscription of many species, the author and date of new combi-

nations would also vary according to taxonomic opinion. Since the dates would vary, the legitimate name for a species, determined by priority, would likewise vary. The problem arising out of attributing genera to the authors who misinterpreted them would be as overwhelming. How many genera *Thelephora* are there? or *Sphaeria*? or *Mucor*? One of each, or as many as there are authors who have emphasized in their writings characters or species not possessed by the types (whatever they may be)? Schroeter described *Tulasnella* for one species; Rick described the genus and three species, all new and none, apparently, congeneric with Schroeter's; Clements & Shear characterized the genus (in a key) so as to include only species of *Sebacina*, and designated an alien species as genotype. Must a student of *Tulasnella* deal with *Tulasnella* Schroet., *Tulasnella* Rick, and *Tulasnella* Clements & Shear? There was considerable discussion at Amsterdam over what to do with misapplication of names, and it was held that "misapplications of names should not be included in synonymy." (Proc.**1**: 344–345, 363–364.) Perhaps in order to expand the already ample field of labor of taxonomists, they are being asked to accept the answer: misapplications of names are to be treated as valid publication of new taxonomic entities.

There is more that is pertinent to the question, in the Rules and in the writings of taxonomists. Art. 45: "The date of a name or epithet is that of its valid publication." Art. 46: ". . . it is necessary to cite the author who first published the name in question." Art. 47: "An alteration of the diagnostic characters or of the circumscription of a group without exclusion of the type does not warrant the citation of an author other than the one who first published the name." (For discussions and citation of the amendment adopted at Amsterdam, see notes under *Phoma*.) It is submitted that in the example just given, of the genus *Tulasnella*, Rick did not exclude the type merely by failing to include it; otherwise almost any treatment of only a part of the species of a genus may exclude the type; and that although Clements & Shear's key would exclude all genuine members of the genus they did not by their erroneous characterization exclude the type in the sense of the Rules — any more than Fries excluded the type of *Agaricus* by attributing asci to the genus, or of *Tremella* by describing the Tremellinei (1849) as having "monosporous sporophores"; "exclusion of the type" here must mean explicitly removing the type [species] from the [generic] group, if it means anything. Art. 50: "An alteration of the diagnostic characters, or of the circumscription of a group, does not warrant a change in its name . . ." — and under Art. 46 the author who first published a name must be cited. And finally, there is no provision anywhere in the Rules for the invention of names in order that they may be conserved; presumably no one considered such a procedure possible. That these interpretations of the Rules are elsewhere accepted can be made clear by a few examples: "*Torula* sensu Turpin = *Torulopsis*. . . . Turpin (1838) did not make a new genus." (Ainsworth & Bisby 1943 p. 300, 1945 p. 320; cf. also Bisby p. 83.) "It is wrong to cite as a

synonym, for example, '*Dothiora* Berk. non Fr.', for Berkeley did not make a genus *Dothiora* by adding to Fries's genus a species that did not belong there." (Bisby p. 47.) "Since the adoption of the type-species method of fixing the application of generic names, [this] proposal appears unacceptable. The monotypic *Carlia* Rabenh. cannot become another genus as the result of the addition by Bonorden of two further species. . . . *Carlia* Bon. . . . has no valid existence." (BMS 1 p. 219). It is submitted that "monotypic" is here not an operative word; the statement is a truism, whether *Carlia* Rabenh. was published for one species or a dozen. It is further submitted that since "*Carlia* Bon. . . . has no valid existence." the interpolated sentence (l.c.) "*Carlia* Bon. could only become a valid genus if it were conserved against *Carlia* Rabenh." is inacceptable; conservation is not a means of bringing names into existence, but of retaining existing names. That the procedure under discussion is actually held to involve the bringing into existence of new names is, however, shown by the following quotations: "The pith of the proposal is to replace the real type species of *Hypospila* Fr. (*H. inustum*) by *H. pustula* (Fr.) Karst.; that is, to make a new genus *Hypospila* Karst., and to conserve it against *Hypospila* Fr. (1825) and *Phoma* Fr. (1823)." ". . . It is recommended that a genus *Hypospila* Karst. be not erected." (BMS 3 pp. 284, 285.) It would be curious to observe the nomenclatural consequences if a genus *Hypospila* had been erected by someone in 1940 (when the B.M.S. committee recommended against it) and subsequently conserved. The author of the genus so erected could not be Karsten, of course, but would need to be the one who erected the genus, or at most "Karst. ex Auct." (Art. 48). Some species published in *Hypospila* Fr. would have to be transferred to *Hypospila* Auct. non Fr., and since if the familiar epithets were used "the resulting binary name[s] [would be] later homonym[s]" (Art. 54) they presumably would have to be replaced by newly created binomials.

Briefly, it is submitted that the treatment of misapplications as publication of new groups is contrary to the Rules and to "established custom," would greatly increase the labors of taxonomists, and, to return to Briquet, violates "the principle of being exact," which is "the only ethical principle which has made science possible" (quoted by Sayers, D., in *Gaudy Night* ch. 17). Mycologists who have used *Acrothecium* for the wrong fungi can learn to use it for the right ones, and can learn the right genus for the false acrotheciums. (For an essay embodying this philosophy, see Fernald in Rhodora **50**: 247–249. 1948.)

AGARICUS FR. vs. PSALLIOTA QUÉL. and PRATELLA GILL. — IR p. 123; IRA p. 39; Donk 1941 p. 182; BMS 3 p. 289; Singer & Smith 1946 pp. 247, 291; Wheeler.

As pointed out by all the authors here cited, and as is apparent from the dates of the genera in question, *Agaricus* is valid without conservation. The proposal can legitimately have no other effect than to burden the literature, and should be rejected.

Psalliota (Fr.) Quél. was published in Soc. Émul. Montbéliard Mém. ii **5**: 139 and in Ch. Jura Vosges 107. Cf. note under *Flammula*.

ALBUGO PERS. EX GRAY and CYSTOPUS LÉV. — Ramsbottom 1916 p. 77; Wakefield p. 242; Fitzpatrick p. 192; Rehder et al. p. 421; Ainsworth & Bisby 1943 p. 80, 1945 p. 86.

Cystopus Lév., Ann. Sci. Nat. iii **8**: 371. 1847, antedates *Cystopus* Blume, Fl. Jav. Nov. Ser. 69. 1858, and so is unaffected by the existence of the homonym. It is, however, long antedated by *Albugo* Pers. ex Gray, Nat. Arr. **1**: 540. 1821. This latter name has been excluded by some authors (e.g. Ainsworth & Bisby) on the grounds that it is pre-Systema. In the sense of being published after the beginning of the Systema of Fries it is clearly post-Systema. In the sense of being published before the "group" in question was "first treated in the Systema" (Ramsbottom, Brit. Mycol. Soc. Trans. **18**: 315. 1934) both *Albugo* and *Cystopus* — and all other names for the group until the end of time — are pre-Systema; for the group was never treated in the Systema at all (Ramsbottom). It thus presents one of the difficulties of the multiple-starting-point interpretation of Art. 20(f) advocated by some authors. It is maintained by the present writer that *Albugo* is a legitimate name from its 1821 publication by Gray; but that is a matter to be argued more fully elsewhere; all that need be observed here is that *Albugo* is not definitely excluded by the starting-point Rule. *Albugo* might also be excluded under Art. 57 (the former Art. 49 bis). Ramsbottom writes (p. 79) that "the oospore stage was first described by de Bary"; and since he recognizes the applicability of the perfect state Rule to Phycomycetes (cf. Rogers 1948 p. 247), he considers the valid name for the group to be *Cystopus* de Bary 1863 (which is antedated by *Cystopus* Blume 1858), and that "the specific names must begin with de Bary."

This seems to be a good argument from a doubtful premise. As already noted in connection with the controversy concerning *Milesia* and *Milesina* (Rogers 1948 pp. 250–251), "the type . . . of a generic name is a species, that of the name of a species . . . is usually a specimen" (Art. 18). The applicability of *Albugo* and of *Cystopus* Lév. to the perfect state depends not on whether the authors who published them recognized the presence of oospores, but on whether oospores were present in their specimens. To argue otherwise would be to discard, as names applied to the imperfect state, all names applied to Basidiomycetes without recognition of the presence of basidia — i.e., most names published before 1837, and many later ones. It seems reasonable to suppose that at least a part of the material that Persoon (or Gray) and Léveillé had in hand contained oospores, even though the authors did not describe them. It is therefore submitted that their names are not rendered "of only temporary value" by Art. 57. If the probability can be shown, by those well aquainted with the fungi in question or with authentic specimens, that the authors did not have oospores in their material, Ramsbottom's conclusion of course supersedes the one offered here.

There appears to have been no formal proposal for the conservation of the name *Albugo*. Even so, the possibility of its retention has been so many times discussed (in print or elsewhere) that it has appeared useful to examine the question. The conclusion offered is that *Albugo* is not rejected by the existing Rules. If it is rejected by modifications hereafter adopted, or from study of original specimens, it would seem better to use *Cystopus* Lév. than to attempt special action in the matter; and only if both *Albugo* and *Cystopus* Lév. are shown to be inapplicable under Art. 57 to conserve *Cystopus* Bary vs. *Cystopus* Blume. But conservation is neither proposed here nor recommended.

ALEURODISCUS RAB. EX CKE. VS. CYPHELLA FR. — Donk 1941 pp. 156, 159.

The author of this proposal gives a number of cogent reasons for considering *Cyphella digitalis* the type of *Cyphella*. To these may be added another: (5) Corda (Anleit. Stud. Mykol. 154. 1842) definitely designated it as the type: "wir betrachten *C. Digitalis* als Normart. . . ." It seems quite clear that *C. digitalis* is the type of the heterogeneous *Cyphella* Fr.; it is even clearer that *C. digitalis* is an *Aleurodiscus*. Since nothing but confusion could be achieved by calling all present *Aleurodisci* by the name *Cyphella*, the proposal should be adopted — with one correction: the date of publication of *Cyphella*, Syst. Mycol. **2**: 201, is 1822, not 1823.

AMPHISPHAERIA CES. & NOT. VS. SPHAEROPSIS LÉV. — BMS 2 p. 288.

On the showing of the B.M.S. committee, *Amphisphaeria* Ces. & Not., Soc. Crittogam. Ital. Comm. **1**: 223. 1863, was published for eighteen species including the type of *Sphaeropsis* Lév. 1842 (q.v.); the name *Sphaeropsis* is then the valid one for the genus. Since, however, *Sphaeropsis* is so much better known in its misapplication by Saccardo, its use for the species of *Amphisphaeria* would make it "a permanent source of confusion or error"; it should then be rejected as a nomen ambiguum under Art. 62. If that course be taken *Amphisphaeria* seems to be available for the genus. But *Amphisphaeria* is illegitimate under Art. 60(1) as amended at Amsterdam (see citation under *Sordaria*), being "nomenclatorially superfluous when published," and can be revived only by conservation. It is recommended that the proposal be adopted.

APIOSPHAERIA SACC. VS. CONIOTHYRIUM CORDA — IR p. 124; IRA p. 39; BMS 2 p. 287.

There is no *Apiosphaeria Sacc.*; in the place cited in the proposal one finds only a brief description of the genus *Apiosphaeria* Berk. (see discussion under *Acrothecium*). Even if Saccardo had in that place erected a genus *Apiosphaeria*, it could not be typified, as is proposed, by *A. pinea*; the only species which Saccardo mentions is "*A. Pulviscula* S." Finally, "*A. pinea* Sacc. Mich. I 126," the proposed type, is itself a fiction; one finds rather, l.c., *Phoma pinea* Sacc. *Apiosphaeria pinea* (Sacc.) Sacc., Syll. Fung. **3**: 169. 1884, was published too late to be the type of an 1880 Sac-

cardoan genus, and, *a fortiori*, of an 1860 Berkeleyan genus. The only proposal that could be entertained is to conserve *Apiosphaeria* Berk. 1860, with one of Berkeley's species as the type, against *Coniothyrium* Corda 1840; since it is not evident that this would accomplish any desired end, the proposal should be rejected. See notes under *Coniothyrium*.

ASCHERSONIA MONT. VS. ASCHERSONIA ENDL. — Donk 1941 pp. 159, 182.

Donk points out that *Aschersonia* Endl. (a renaming of *Laschia* Jungh. non Fr.) embraces two species neither of which at present appears to need a genus of its own, and has never had any currency, whereas *Aschersonia* Mont. of the Fungi Imperfecti is widely used and of some importance. There seem to be no obstacles to the proposal, whose desirability should be investigated by students of the imperfects. See also notes under *Hymenogramme*.

AURICULARIA BULL. EX SECR. VS. AURICULARIA BULL. EX FR., AURICULARIA WAHLENB., and LASCHIA FR. — Donk 1941 pp. 156, 160; Martin 1943.

If, as Donk asserts, *Auricularia* Pers., Mycol. Eur. **1**: 97. 1822, is pre-Friesian and invalid, some such proposal as Donk's (given above) would probably be found desirable. If, as Martin contends, *Auricularia* is validly published by Persoon, the motion is useless. Since Martin's case has the support of the existing Rules, the proposal should be shelved, to be revived only if alteration of Art. 20(f), the starting-point rule, excludes his interpretation and makes necessary the conservation (or rejection) of *Auricularia* as currently used. See also notes under *Stereum* and *Hirneola*.

CALOCERA (FR.) FR. and CORYNOIDES GRAY. — Doty p. 129.

No proposal for conservation of *Calocera* seems to have been offered, nor is one made here; since the possibility of conflict exists, the matter is here discussed. Since Fries published *Calocera* only as an infrageneric group in 1821 (Syst. Mycol. **1**: 463, 485) and did not raise it to generic rank until 1825 (Syst. Orb. Veg. 91), it is antedated by *Corynoides* Gray, Nat. Arr. **1**: 654. 1821. Gray's genus included four species: *C. cornea* (= *Calocera*), *C. fabarum* (based on Sowerby's pl. 404 and later named *Merisma pusillum* Pers., Mycol. Eur. **1**: 158. 1822), *C. farinosa* (= *Spicaria* or *Isaria*), and *C. byssoides* (= *Ceratiomyxa fruticulosa*). Since *Corynoides* antedates the generic names *Calocera*, *Spicaria*, and *Ceratiomyxa*, to select the first, third, or fourth of Gray's species as the type would necessitate the rejection of a well-established name. The status of *C. fabarum* Gray is quite different. Gray cites Sowerby's Tab. CCCCIV as "*Clavaria fabae* Sowerby"; but where, or whether, that name was published is not apparent. Sowerby's text refers to the plate as representing "*Clavaria rugosa*"; since his material occurred on bean-stalks (*Faba*), it seems likely that Gray actually referred to that plate. Plate 404 is certainly not the same *C. rugosa* as that shown in Pl. 235, the type of *Clavaria ceranoides* Pers., Syn. 594, ex Fr., Syst. Mycol. **1**: 481. Cotton & Wakefield, Brit. Mycol. Soc. Trans.

6: 164–198, refer to neither *Clav. fabae* nor *Corynoides fabarum* nor to Sowerby's Plate 404. *C. fabarum* seems to be a species completely lost; and as such it is an admirable lectotype for a generic name whose discovery could be so useless and inconvenient. If *Corynoides* has not already been validly typified (cf. Ainsworth & Bisby 1943 p. 73, 1945 p. 79), *C. fabarum* is here designated as its lectotype. Perhaps then *Calocera* will remain undisturbed. The essentials of this discussion have been accepted by Doty.

CALODON (QUÉL.) KARST. vs. HYDNELLUM KARST. — IR p. 123; IRA p. 39; Donk 1941 p. 183.

Miller (Mycologia **25**: 300. 1933) treats the listing of the name *Calodon* Quél. in Clav. Hym. as valid publication; Donk, following Banker, treats it as a tentative name, published, l.c., only as a synonym of a section of the genus *Hydnum*. Examination of the Clavis Hymenomycetum seems to bear out the judgment of Banker, Donk, and the author of the proposal under consideration, that *Calodon* had no nomenclatorial standing until after the publication of *Hydnellum*. (*Hydnellum* is usually cited from the reprint; according to the complete volume, it was published in Soc. Faun. Flor. Fenn. Medd. **5**: 41. 1880.) Donk rejects the proposal on the grounds that among those recognizing the segregate genera of stipitate Hydnaceae there is no unanimity in favor of *Calodon*, and that to the majority of mycologists, who are still employing *Hydnum* for all stipitate species of the family, the choice between the two names is a matter of indifference. To these may be added the observation that it is by no means certain that *Calodon* and *Hydnellum* are synonymous, nor that they will not both be maintained, for different groups. It is recommended, as by Donk, that the proposal be rejected.

CALVATIA FR., Summ. Veg. Scand. 442. 1849 — Type: *Bovista craniiformis* Schw. — vs. LANGERMANNIA ROSTK. in Sturm, Deutschl. Flora III **5**: 23. 1839 and HIPPOPERDON MONT., Ann. Sc. Nat. Bot. ii **17**: 121. 1842.

This proposal was recommended by the late Dr. S. M. Zeller, and is here first published. *Calvatia*, l.c., is monotypic, and there is therefore no question concerning the type of the genus. The synonyms to be rejected have been neglected by all students of the group since their publication and are not in current use; the proposal therefore would accomplish the object of conservation, "to avoid disadvantageous changes in the nomenclature of genera" (Art. 21). *Calvatia* is widely known, of some size (in number of species), and of considerable importance. It is here recommended that the proposal be adopted.

CIENKOWSKIA ROST. and CIENKOWSKYA REGEL & RACH and CIENKOWSKYA SCHWEINF. — Rehder et al. p. 408.

The conservation of Rostafinski's genus is not expressly proposed by Weatherby (l.c.), who merely points out that if the name is to be retained

it must be conserved against its homonyms. Since the genus has but one species, it is here recommended that *Cienkowskia* be not conserved.

CLADOCHAETE SACC. and CLADOCHAETA DC. — Rehder et al. p. 410.

In the discussion cited Weatherby points out the possibility that conservation of *Cladochaete* is necessary, but does not explicitly propose it. The question here is the same as that discussed in these notes under *Cyttaria* (q.v.) — whether or not the names actually are homonyms. Temporarily the position is here taken — on the grounds advanced with respect to *Cyttaria* — that they are not.

CLADODERRIS PERS. EX BERK. VS. CYMATODERMA JUNGH. — Donk 1941 pp. 156, 163.

As Donk states, if the name *Cladoderris* is to be retained conservation is necessary. The genus includes but few species (four distinct ones, according to Lloyd's account, in Myc. Writ. **4.** 1913) and is of no great importance in any respect; it is doubtful that conservation, which should be reserved for critical or important cases, ought to be invoked here, and rejection is recommended.

CLAVARIA VAILL. EX FR., Syst. Mycol. **1**: 465. 1821 — Type: *C. fragilis* Pers. ex Fr., l.c. p. 484 — vs. CLAVARIA STACKHOUSE, Ner. Brit. 2 ed. x. 1816. — Donk 1933 p. 74; Doty p. 126.

Donk suggested the possibility that because of Stackhouse's work (which he was unable to find) *Clavaria* might stand in need of conservation. There is a genus *Clavaria* Stackhouse, validly published in 1816, but never subsequently used, for a group of marine algae. Doty proposes the motion for conservation here cited. There is no obstacle to its adoption, and every reason, under Art. 21, why *Clavaria* Fr. should be conserved. Adoption is recommended.

COLLYBIA (FR.) QUÉL. VS. GYMNOPUS GRAY — Ainsworth & Bisby 1943 pp. 67, 128, 1945 pp. 73, 138; Singer & Smith 1946 pp. 249, 251.

Singer & Smith have so typified *Gymnopus* that it can either be considered a synonym of *Mycena* Pers. ex Gray or used for a possible segregate of that genus. If their lectotype be retained there is no need to conserve *Collybia* against Gray's name; it is recommended that the proposal not be adopted.

CONIOSPORIUM SACC. VS. CONIOSPORIUM LINK EX FR. — Mason 1933 pp. 15, 22; Ainsworth & Bisby 1943 p. 69, 1945 p. 75.

Mason states that the type specimen of the type species of Link's genus "has many-celled spores" and that "the genus . . . is accordingly not available for the large number of species with 1-celled spores, which have been compiled under *Coniosporium* in the Sylloge." Since there is no *Coniosporium* Sacc. (see discussion under *Acrothecium*) but only (in Michelia **2**: 21) the genus "Coniosporium Link," it is recommended that the proposal be rejected.

CONIOTHYRIUM CORDA vs. CLISOSPORIUM FR. — IR p. 124; IRA p. 39. CONIOTHYRIUM SACC. vs. CLISOSPORIUM FR. and CONIOTHYRIUM CORDA — BMS 2 p. 285.

First, of the proposal published in IR, it should be noted that the proposed lectotype was not published until long after Corda's death, was unknown to him, and consequently cannot have been the type of his genus; the type must be one of the four species originally included in it by Corda. As a representative of his genus Corda gave, in his Einleitung lxxxvii. 1842, the single species *C. Pini*; but "a[bgebildet] A[rt]" is not necessarily the same as "Grundform dieser Gattung," a phrase which Corda uses elsewhere, and probably there is no reason to select this species rather than one of the others as the type. In Michelia **2:** 7 Saccardo writes "*Conithyrium* Corda, Fuck."; but since Fuckel, in Symb. Mycol. 377, describes only his own species, apparently having seen none of Corda's, he cannot furnish the desired typification. In Syll. Fung. **3**: 305 Saccardo limits the genus to species with "sporae fuligineae," in so doing excluding all of Corda's original species except *C. Palmarum*, the only one to which Corda ascribed colored spores. Unless an earlier acceptable typification exists, Saccardo may then be considered to have designated *C. Palmarum* as the lectotype of *Coniothyrium* Corda.

There is, of course, no genus *Coniothyrium* Sacc. (see notes under *Acrothecium*). If the B.M.S. committee be followed in considering *Clisosporium lignorum* the type of *Clisosporium* Fr., and Saccardo in including *C. lignorum* in *Coniosporium*, Corda's genus, which is said to be widely employed, falls into synonymy with Fries's neglected name. There seems no obstacle to the conservation of *Coniothyrium*, and it is here recommended that it be conserved — but in the permissible form:

Coniothyrium Corda . . . — Type: *C. Palmarum* Corda — vs. *Clisosporium Fr.* . . .

CONOCYBE FAYOD vs. RADDETES KARST., PHOLIOTINA FAYOD, and PHOLIOTELLA SPEG. — Donk 1941 p. 156, 163; Singer & Smith 1946 p. 284.

On Donk's showing *Pholiotina* was effectually reduced to synonymy by Kühner, *Raddetes* would not at present be considered congeneric with the type of *Conocybe*, and *Pholiotella* has never been used since its publication. Singer & Smith state that the name *Conocybe* is valid. There is, nevertheless, as Donk points out, the real possibility that in the future someone, using a broader concept of the genus *Conocybe* than that now employed, would include with it species of *Raddetes* and would feel compelled to use the relatively unknown Karsten name. Since the mechanism of conservation is explicitly provided "to avoid disadvantageous changes in the nomenclature of genera," such a preclusive motion not only is in order, but is the most desirable sort of motion for conservation. It is recommended that the proposal be adopted. See notes under *Galera*.

CORDYCEPS FR. VS. CORDICEPS LINK — IR p. 121; IRA p. 39; BMS 3 p. 282.

As pointed out by the British committee, there is no "*Cordiceps* Link," his spelling being the same as Fries's; nor is there any conflict in application of the name, *C. militaris* being a principal element of the genus in both authors. The proposal should therefore be rejected.

It is not correct to state, however, as the committee has done, that "The generic name is *Cordyceps* (Fries [ut 'Trib.' sub *Sphaeria*, Syst. Mycol. II, ii, 323, 1823]) Link (1833)." It may well be that Link intended to elevate Fries's group to generic rank (he included most of its species); but in fact he nowhere cites Fries. The genus is therefore *Cordyceps* Link 1833. The only difference is in gender: *Cordyceps* Link is masculine, and *Cordyceps* (Fr.) Fr. (1849) feminine.

CORTICIUM FR. VS. PHLEBIA FR. and RICNOPHORA PERS. — Donk 1941 pp. 156, 164; Shear 1943.

CORTICIUM PERS. EX FR. VS. CORTICIUM PERS. EX GRAY — Ainsworth & Bisby 1943 p. 72, 1945 p. 79.

In connection with this proposal there is a subsidiary point which is of interest beyond the immediate case; this is a matter of selection of types, and arises out of the asserted synonymy of *Phlebia* and *Ricnophora*. Donk states that *P. radiata* Fr., which Fries designated (in 1828) as the genotype, is a *Ricnophora*, and that therefore the genera are obligate synonyms. Since Persoon stated on publishing *Ricnophora*, "Phlebia *radiata* . . . et . . . Phlebia *contorta* (quae tantum varietas videtur) verosimile huc pertinent" (Mycol. Eur. **2**: 8. 1825), the facts advanced may be taken as established. But the conclusion does not follow; for Persoon continues ". . . nec vero Phleb. *Merismoides* et *vaga*, quae ad auctoris genus reservari possunt," and follows this with a description of *Phlebia* Fr. and the two species which he retains in it.

To summarize this: (1) Fries published a genus with four species (1821). (2) Persoon, believing that genus to be heterogeneous, published a new genus (1825) to which two of the species (in his opinion) properly belonged, and explicitly reserved the remaining two species to Fries's genus. (3) Fries (1828) designated as the type one of the species which Persoon had excluded from Fries's genus.

Now according to "established custom," which "in the absence of a relevant rule . . . must be followed" (Art. 5), the first author to designate a lectotype, directly or by implication, has the right of choice, and must be followed unless there is a cogent reason for overruling his decision. In dividing the heterogeneous *Phlebia* into a part which should remain under that name and a part which should be removed Persoon was exercising a right of choice possessed by all and, unavoidably, exercised by most taxonomists. He "reserved" to *Phlebia* two of its four original species; and according to established custom one of them should be recognized as the type. Since *P. vaga* was later made the type of Karsten's genus *Phlebiella* (Hedw.

29: 271. 1890; cf. Mycologia **36**: 79. 1944), it would be logical and in accord with established custom to designate (provided no intervening decisions oppose) the other eligible species, *P. merismoides* Fr., as the type of *Phlebia* Fr.

Except that it involves a point of nomenclatorial practice which is important beyond the case under consideration, the typification of *Phlebia* is apparently of no consequence. Neither, probably, is the typification of *Corticium* Pers. 1794; but if it ever should be necessary to typify that pre-Friesian genus, it should be noted that *C. roseum*, which Shear regards as a "good species of *Corticium*" and which Donk regards as the type (although in a footnote he excludes it from "Corticium Fr." as "generically different"), is often treated as an *Aleurodiscus* (cf. Rogers & Jackson p. 299), and that *C. laeve* (cf. Rogers & Jackson p. 318) may be the one original species still retained in *Corticium*, and as such, as Shear points out, shoud be regarded as the type of Persoon's genus.

Finally, *Corticium* Fr. 1836 is a later homonym of *Corticium* Pers. ex Gray, Nat. Arr. **1**: 653. 1821. Under this name Gray listed only the single species *C. Quercinum* (Pers., Syn. Meth. Fung. 573, ex Fr., Syst. Mycol. **1**: 442, sub *Theleph.*), which must therefore be the type. Now *C. Quercinum* is generally considered a member of *Peniophora* Cooke; in fact, in justifying the erection of that genus Cooke gave his chief attention to *C. Quercinum* (Grev. **8**: 18. 1879), which should therefore be accepted as the genotype. *Peniophora* Cke. is consequently an obligate synonym of *Corticium* Pers. ex Gray; this conclusion is neither arbitrary nor mechanical, and would probably have been accepted by the author of the later genus if he had been acquainted with Gray's rather than Fries's treatment of *Corticium*.

In order "to reserve the name *Corticium* Fr. for that group of species which [is] at present held together under that name," Donk proposes to typify it by *Thelephora confluens* Fr. This, it appears, is contrary to Fries's own description. The whole characterization of *Corticium* as Fries first used it (Fl. Scan. 340. 1835) is "Hymenium ascigerum ceraceum, humectatum tumens, primitus setulosum, ascis perfectis = *Corticium*." If one amends the description by disregarding the "asci," he has left as Friesian generic characters "hymenium waxy, swelling when moistened, at first setulose." The texture described here might well be that of *Corticium confluens*; but that species is not setulose; any setulose species would by current workers be assigned to *Peniophora* (since the texture described is wrong for *Hymenochaete*). At the end of his key to the Auricularini (from which the foregoing description is extracted) Fries wrote "Cfr. Gen. Hymen." In Gen. Hym. 15. 1836 Fries (or Laurell, whose name appears on the title-page), gives a much longer description, which reads, in part, "Hymenium subdiscretum, ceraceum, udum molle tumens; siccum rigens . . . ; primitus laeve subsetulosum." Similarly in Epicrisis 556. 1838 Fries wrote "paraphysibus plerumque emersis setulosis pellucidis (nudo oculo vix conspicuis)." It would therefore appear that one who is to

typify *Corticium* Fr. as Fries conceived it is bound to select, either from the two species, *C. sulphureum* and *C. velutinum*, listed in Gen. Hym., or from the longer list in Epicr., a "setulose" species, and that *Corticium* Fr. is not merely a homonym but also a synonym of *Corticium* Pers. ex Gray and a synonym of *Peniophora*.

Like Donk (and presumably all other mycologists) Shear believes "that it is important to conserve as far as is practicable the present names of our well known and widely distributed genera," and accordingly proposes *C. laeve* as the type of *Corticium* Pers. Unlike Donk, Shear does not wish to work under the International Rules, which eliminate from consideration all names of Hymenomycetes published before 1821. Whatever may be said for or against the starting-point rule, it is certain that under the existing Rules mycologists are concerned not with *Corticium* Pers. 1794 but with *Corticium* Pers. ex Gray 1821 and *Corticium* Fr. 1835, 1836, and 1838. And it has here been shown that *Corticium* Pers. ex Gray and *Corticium* Fr. are earlier synonyms of *Peniophora* Cke. This is perhaps not so disadvantageous as would at first appear. For it has frequently been pointed out, most recently by Jackson, in Can. Jour. Res. C **26**: 129, 143–145. 1948, and Wakefield, Brit. Mycol. Soc. Trans. **30**: 155. 1948, that the phyletic relations are not within *Corticium*, *Peniophora*, and their kin, but across the generic lines at present accepted; that many members of *Corticium* are more closely related to members of *Peniophora* than to other corticiums; and that classification according to the indicated groups is certain to break up the genera now in use. As such revision is accomplished both of the generic names in question will lose the meanings they now carry, and their retention in new senses will prove confusing rather than enlightening. It is then perhaps as well that one of them — *Peniophora* — will ultimately have to be discarded on nomenclatorial grounds. Meanwhile, both names can be used as Donk uses *Poria*, allowing each to stand "ohne sichere systematische Stellung," as a "Sammelgenus" (Nederl. Mycol. Ver. Med. **23**: 217. 1933). Since both *Corticium* and *Peniophora* in the current sense are taxonomic monstrosities, no conservation can bring about the retention of either name in the current sense; it is recommended that the proposal be rejected.

CORTINARIUS FR. VS. CORTINARIA GRAY — Singer & Smith 1946 pp. 253, 255, 294.

Cortinaria was used by Persoon (Syn. Meth. Fung. 276) in 1801 for a section of *Agaricus*. In 1815 Fries adopted it as a "family" of *Agaricus* (Obs. Mycol. **1**: 6), and in 1821 as a "series" of *Agaricus* (Syst. Mycol. **1**: 10; p. 210 with reference to Persoon). In 1821 also Gray used the group as a genus (Nat. Arr. **1**: 627). In 1825 Fries changed the rank of his group from series to subgenus (Syst. Orb. Veg. 66) and spelled it *Cortinarius* (p. 69); in 1835 he briefly described the genus *Cortinarius* (Fl. Scan. 339) with a reference to his (? unpublished) Genera Hymenomycetum, and again in 1836 (Gen. Hymen. 7), without explicit reference

to any earlier treatment. His prefatory discussion, however, and especially the statement (Gen. Hymen. 5), "Ipse greges quasdam maxime recedentes a genere [*Agarico*] removi," imply that it was one of his earlier groups and would seem to justify the citation of *Cortinarius* as "(Pers. ex Fr.) Fr., Fl. Scan." But whatever the nomenclatorial relation between *Cortinarius* 1836 and *Agaricus* ser. *Cortinaria* 1821, it seems clear that they were published by Fries for essentially the same group; it is fully apparent that Fries at first used not only Persoon's name but his spelling, and that *Cortinarius* is merely an altered spelling of *Cortinaria*.

The proposal to conserve *Cortinarius* arises from the assumption that *Cortinarius* "is not a variant spelling according to the Rules," and that adoption of the valid *Cortinaria* (Pers.) ex Gray would necessitate a large number of transfers from *Cortinarius* (Pers. ex Fr.) Fr. The applicable Rule is Art. 70: "When the difference between two generic names lies in the termination, these names must be regarded as distinct, even though differing by one letter only. This does not apply to mere orthographic variants of the same name." It is submitted that *Agaricus* sect. *Cortinaria* Pers. ex Fr. and *Agaricus* subg. *Cortinarius* (Pers. ex Fr.) Fr. are "mere orthographic variants," and that *Cortinaria* (Pers.) ex Gray and *Cortinarius* (Pers. ex Fr.) Fr. are such in exactly the same degree; and that in consequence the first sentence quoted from Art. 70 "does not apply," because of the second. Since it is obvious that *Cortinaria* and *Cortinarius*, if used for the same genus, would produce "serious risk of confusion," they are orthographic variants not only from their history, but also by the provisions of Art. 70(3). Because of lack of citations for the "examples of different names" given under Art. 70, it might appear that the pair of "different" names *Peponia* and *Peponium* would contradict this conclusion. That example is elucidated in Kew Bul. Mis. Inf. **1940**: 83: the names declared different are not *Peponia* Naud. of the Cucurbitaceae and *Peponium* Engl. based on it, but *Peponia* Grev. of the Baccilariaceae and *Peponium* Engl. of the Cucurbitaceae. In conclusion, then, *Cortinaria* Gray and *Cortinarius* Fr. are not different names, and therefore no transfers are required to use the valid (Art. 70) earlier spelling. It is recommended that the proposal be rejected.

CYTTARIA BERK. VS. CYTTARIUM PETERM. — Rehder et al. p. 422.

The conservation of Berkeley's genus is recommended, l.c. The necessity for conservation, if *Cyttaria* is to be retained, arises out of Art. 70: "When the difference between two generic names lies in the termination, these names must be regarded as distinct, even though differing by one letter only. This does not apply to mere orthographic variants of the same name." The names in question are clearly "mere orthographic variants," and consequently cannot be "regarded as distinct" under Art. 70. According to the "examples of different names" listed under that Article, however, they are "different" — as different as *Monochaete* and *Monochaetum*, there cited. This curious contradiction between distinctness and difference will

be, it is hoped, clarified at the next Congress. The decisive clause at present appears to be that occurring in Note 3 under Art. 70: "the essential consideration is whether they may be confused with one another or not." This clause is here accepted as a guide (as by Rickett in Brittonia **6:** 365–6. 1948), rather than the questionable anonymous dictum in Kew Bul. Mis. Inf. **1940**: 83 that "generic names ending respectively in the masculine, feminine and neuter terminations *-us*, *-a*, *-um*, are held to be different." There seems in fact to be no danger of confusion of *Cyttaria* with the long-abandoned angiosperm genus *Cyttarium*; accordingly it is held that at present *Cyttaria* is valid without conservation. It is recommended that the proposal be tabled until some clarification of the Rules makes it again a useful proposal.

DALDINIA CES. & NOT. vs. HEMISPHAERIA KLOTZSCH, PERISPHAERIA ROUSS., and PERIPHEROSTOMA GRAY — IR p. 121, 127; IRA p. 39; BMS 3 p. 283.

As noted by the B.M.S. committee, Roussel's genus is pre-Friesian and therefore does not conflict with *Daldinia*, and *Cercidospora* is included in IR as a synonym of *Daldinia* only by error. The committee's statement that *Peripherostoma* 1821 is "invalid because pre-*Systema*" has been questioned (Mycologia **33**: 569. 1941). What the committee has written of the taxonomic character of *Perisp*[*h*]*aeria* and *Peripherostoma* — that they include a number of species of *Hypoxylon*, with *Daldinia concentrica* heading the list — is equally true of *Stromatosphaeria* Grev., Fl. Edin. lxxiii. 1824. Both *Peripherostoma* and *Stromatosphaeria* could be excluded from conflict with *Daldinia* by appropriate typification; or both could be excluded by being listed as nomina rejicienda. Since on the showing of the B.M.S. *Hemisphaeria* must conflict with *Daldinia*, and unless the latter is conserved must replace it, it is recommended that the motion to conserve *Daldinia* and reject *Hemisphaeria* be adopted. And since "a conserved name is conserved against all other names for the group, [etc.]" (Art. 21, Note 3), this action would prevent the displacement of *Daldinia* by *Peripherostoma* or *Stromatosphaeria* as long as *Daldinia* is retained in its current sense; it is therefore recommended that these other names not be listed as rejicienda, but be left available for other groups of fungi represented among their original species.

DICTYOLUS QUÉL. vs. LEPTOGLOSSUM KARST. — IR p. 123; IRA p. 39; Donk 1941 p. 185; Singer & Smith 1946 p. 291; Doty p. 130.

As Donk points out, there seems to be no considerable preponderance of usage in favor of the one or the other of these synonyms, and no compelling reason for making an exception in favor of the later name. It is recommended that Donk be followed and the proposal rejected. Singer & Smith suggest a third applicable name, *Leptotus* Karst.

EMPUSA COHN vs. EMPUSA LINDL. — Ainsworth & Bisby 1943 p. 99, 1945 p. 107; Fitzpatrick pp. 296, 297.

Empusa Cohn, Acad. Caes. Leop.-Carol. Nat. Cur. Nova Acta **25**: 317. 1855, is a later homonym of *Empusa* Lindl. 1824 of the Orchidaceae; it was based on the single species *E. Muscae* Cohn ("*Sporendonema muscae*? Fries Syst. mycol. III. p. 434"). Fresenius soon noted Lindley's homonym (Bot. Zeit. **14**: 883. 1856), as well as two homonyms among insect genera, and therefore wrote "Ich schlage deshalb . . . die Benennung 'Entomophthora' vor und subsumire nun darunter als Arten: 1. *Entomophthora Muscae* . . . *Empusa muscae Cohn* . . . . 2. *Entomophthora Grylli* . . . . 3. *Entomophthora sphaerosperma*." It is clear that *Entomophthora* Fres. was not published as a new genus, which could be used for a segregate from *Empusa*, but only as a new name for *Empusa* Cohn non Lindley et al.; it must therefore have the same type, *Emp. Muscae* Cohn. Since both names have been employed for the group, there appears no particular advantage in retaining the illegitimate name *Empusa*; this is especially true when it is noted that *Entomophthora* has furnished the name for both the family and the order in which the genus is included. It is therefore recommended that the proposal be rejected.

FLAMMULA (FR.) QUÉL. vs. RYSSOSPORA FAYOD, GYMNOPILUS KARST., and VISCULUS EARLE — IR p. 123; IRA p. 40; BMS 1 p. 227; Bisby p. 104; Singer & Smith 1946 pp. 263, 291.

FLAMMULA (FR.) QUÉL. vs. FLAMMULA (DC.) FOURR. — Donk 1941 p. 157, 166; Singer & Smith 1946 p. 263.

FLAMMULA (FR.) QUÉL. vs. GYMNOCYBE KARST. and FLAMMOPSIS FAY. — Singer & Smith 1946 p. 291.

With the exception of *Flammula* (DC.), all of the proposed nomina rejicienda were published later than *Flammula* (Fr.), which therefore need not be conserved against them. Donk and Singer & Smith (p. 263) question the desirability of the retention of *Flammula* for an agaric genus, but come to the conclusion that its conservation may as well be attempted. No recommendation is offered here except that Donk's proposal be adopted if conservation is decided upon; but it appears desirable to draw attention to the fact that not all species discussed in the various attempts to arrive at a typification of *Flammula* are eligible. Donk's discussion, and the second paragraph of p. 244 of Singer & Smith's paper, are pertinent here. It should be noted, however, that although Quélet declares his intention "to elevate to the rank of genera the subgenera of Fries," the subgenera of the Summ. Veg. Scand. are for the most part the tribes of the Syst. Mycol.; and that since tribes are susceptible of typification, when these are changed in rank the types of the tribes become the types of the subgenera or genera based on them. The type of the trib. *Flammula* Fr. must be chosen from among the species included in it in the Systema; that of the subg. *Flammula* (Fr.) Fr. and the gen. *Flammula* (Fr.) Quél. must be that same species. Donk points out, furthermore, that a type was designated for *Flammula*

by Earle (N. Y. Bot. Gard. Bul. **5:** 386) as long ago as 1909. This lectotype was not, however, *A. lubricus*, as Donk states, but *A. gummosus* Lasch, which Donk rightly stigmatizes and rejects as "a species not among Fries' original ones!" So much for acceptable procedure; the designation of a type, like the decision whether or not to conserve *Flammula*, is best left to agaricologists.

There is a minor problem of citation that may deserve comment here. In all of the places listed in the heading of this note *Flammula* is cited as published by Quélet in Champ. Jura Vosges p. 129. Quélet's great work was published in two forms: (a) Soc. Émul. Montbéliard Mém. ii **5:** [43]–332. pl. 1–23 + pl. 1 [= 24]. 1872; IIe partie [333]–427. pl. 1–5. 1873; IIIe partie [429]–556. pl. 1–4. 1875. (b) Champ. Jura Vosges. pp. [1]–320. pl. 1–23 + pl. 1 [= 24]. 1872; IIe partie [321]–424. pl. 1–5. 1873; IIIe partie [1]–28. pl. 1–4. 1875. Barbier, Montbéliard; and Baillière, Paris. Because of the irregular and awkward arrangement of the text in (b), it is here assumed, without conclusive evidence, that (a) was printed first. The length of the page in parts [i] and ii of (b) is less than in (a); for this the text was rearranged (without other alteration) to make about three lines less to the page in (b); therefore not only is the pagination changed, but the pagination of (a) cannot be calculated from that in (b). Part iii has altered pagination but the original page-length; the page in this part of (b) equals the page in (a) minus 428. Now the page (129) given for *Flammula* is the page where that genus appears in (a), the periodical, but the title cited is that of (b), the separate work. It is suggested that for future clarity Quélet's names be cited as published in Soc. Émul. Montbéliard Mém. ii **5:** (the preferred procedure for articles in periodicals) by those having access to that form of the work, and that whenever citation is made of Champ. Jura Vosges the page from the separate volume be given. *Flammula* is Soc. Émul. Montbéliard Mém. ii **5:** 129. 1872, or Champ. Jura Vosges 97. 1872.

GALERA (FR.) QUÉL. VS. CONOCYBE FAYOD — IR p. 124; IRA p. 40; BMS 1 p. 228; Singer & Smith 1946 pp. 264, 291.
GALERA (FR.) QUÉL. VS. GALERA BLUME — Donk 1941 p. 157, 168.

The report of the B.M.S. committee approves the IR proposal to conserve *Galera* for a fungus genus, with the type *G. tenera*. Donk gives what seem entirely cogent reasons for rejecting this typification, but likewise approves conservation. Singer & Smith "cannot see any advantage in maintaining the old generic name *Galera*, which is ambiguous"; they state that "the name *Galerula* Karsten is available to all who wish to use the genus in the concept of Quélet and Saccardo." Donk, on the other hand, treats *Galerula* as an autonomous segregate from *Galera*. The problem thus seems to be taxonomic rather than nomenclatorial, and as such should be left to the experts. If it appears that there is a generic group not segregated from *Galera* which stands in need of a name (as Donk implies) and if *Galera* 1825 of the Orchidaceae can properly be discarded by taxonomists

of vascular plants, Donk's proposal is desirable; otherwise, the procedure recommended by Singer & Smith, to let the homonymous *Galera* (Fr.) Quél. die a natural death, should be followed. See notes under *Conocybe*.

GOMPHUS PERS. vs. GOMPHORA FR. — Donk 1941 p. 157, 169.

This proposal was made solely because of uncertainty whether Persoon's *Mycologia europaea* Sect. 2 was published earlier or later in 1825 than Fries's *Syst. Orb. Veg.* Since *Mycol. Eur.* 2 is cited in *S.O.V.* — e.g., on p. 361 — Persoon's work must have been the earlier. Furthermore, *Gomphus* Gray, Nat. Arr. **1:** 638, 1821, also antedates Fries's variant name; and since the type of Gray's *Gomphus* (*G. clavatus* (Pers. Synops. sub *Merul.*) Gray) is the same fungus as that proposed by Donk as the lectotype of *Gomphus* Pers., the object of the proposal is achieved without special action. The proposal should be dropped.

GUEPINIA FR. vs. GYROCEPHALUS PERS. and PHLOGIOTIS QUÉL. — IR pp. 122, 123; IRA pp. 40, 41; Martin 1936, 1948 p. 116; Donk 1941 p. 185, 193.

GUEPINIA FR. 1828 vs. GUEPINIA BAST. 1812 and GUEPINIA FR. 1825. — Martin 1936.

As Donk notes (p. 193), it would appear that *Phlogiotis*, which in IR appears as a nomen rejiciendum opposite *Pilacre*, was intended rather as an alternative to *Guepinia*. In IR the two appear in successive lines; in IRA, because of alphabetizing, more than a page apart. As pointed out by both Martin and Donk, *Gyrocephalus* Pers., in spite of the authority given to its use by Brefeld, has nothing to do with *Guepinia*.

Guepinia was published in 1825, for *Tremella Helvelloides* DC. That fungus is also the type of *Phlogiotis* Quél. 1886; and, since *Guepinia* Fr. is a later homonym, Martin uses Quélet's generic name for it. If one is wiling to stretch a point in accepting as valid a rather sketchy form of publication (as one must often do for earlier authors), *Tremiscus* (Pers. Mycol. Eur. **1:** 103. 1822 ut subg.) Lév., Consid. Mycol. 108. 1846; d'Orbigny Dict. Univ. Hist. Nat. **8:** 487. 1847,* is a second name to be considered here. Persoon's subgenus included two species, *Tremella fimbriata* and *Tremella rufa*; in order to avoid complications, *T. fimbriata* is hereby designated as the lectotype of that subgenus.

In 1828 Fries added to *Guepinia* a second species, *G. Spathularia*

* Léveillé, J. H. Considerations mycologiques suivies d'une nouvelle classification des champignons. Extrait du Dictionnaire universelle d'histoire naturelle. pp. 136. Paris, Impr. L. Martinet, 1846 — A separate printing, with the text apparently identical, but in single columns, and with different paging, of Léveillé's article "Mycologie" in the *Dict. Univ.* A number of subgenera of other authors are listed as genera — without, or with a minimum of, the apparatus of citation demanded by Art. 37. For *Tremiscus* one finds only:

Section VII. — Trémellés
[Short diagnosis for section]
Genres: . . . *Tremiscus*, Pers.

(Schw.); and in 1838 a third, *G.* ? *Cyphella* (*Cyphella Friesii* Weinm.); that fungus is a member of the genus *Guepiniopsis* Pat. 1883 (q.v.). In the course of thirteen years, then, Fries assigned to *Guepinia* three fungi, now held to be members of three genera in two different families. The name *Guepinia* is a homonym invalid for fungi under the Rules but is not actually employed elsewhere. Since the type, *G. Helvelloides*, has a good name (*Phlogiotis*), Martin and Donk imply that the proposal printed in the Rules may well be rejected; and a third vote for their recommendation is here recorded. Martin proposed that, since for *G. Spathularia* there was no other generic name available, the name *Guepinia* be conserved with that species as the type. It is here submitted that there is no *Guepinia* Fr. 1828. The Nomenclature Committee of the B.M.S. has well written, in another connection, "Since the adoption of the type-species method of fixing the application of generic names, [the] proposal appears unacceptable. The monotypic *Carlia* Rabenh. cannot become another genus as the result of the addition by Bonorden of two further species." (BMS 1 p. 219.) The fact that here Fries himself, rather than another author, added the "further species" does not alter the case. This is in agreement with the final decision of Dr. Martin, who has proposed a new genus *Dacryopinax* to include *G. Spathularia*. It is recommended that the second proposal also be rejected.

GUEPINIOPSIS PAT. VS. GUEPINIA FR. 1830 — IR p. 123; IRA p. 40; Martin 1936; Donk 1941 p. 186.

As noted by Donk, "Fr. Elench. (1830)" is the same as Fr. 1828; the author of this proposal happens merely to have had in his possession one of the copies of the *Elenchus* bearing the later title-page (Ramsbottom, Brit. Mycol. Soc. Trans. **18:** 316. 1934). The present proposal is to conserve *Guepiniopsis* as typified by a fungus not originally included in that genus (but belonging to a different genus) against *Guepinia* as typified by a fungus not originally included in that genus (but belonging to a different family; see notes under *Guepinia*.) "Guepinia Fr. Elench." is a nonentity, and *Guepiniopsis* stands without conservation — for its type species (cf. Martin and Donk). The proposal should be rejected.

GUIGNARDIA VIALA & RAVEZ VS. CARLIA BON. NEC RABENH. — IR p. 121; IRA p. 40; BMS 1 p. 218.

On the showing of the B.M.S. committee there is no *Carlia* Bon., and *Carlia* Rabenh. is not the same as *Guignardia*; conservation is therefore unnecessary and, as proposed, impossible. The proposal should be rejected.

GYMNOSPORANGIUM HEDW. F. EX LAM. & DC. VS. PUCCININA [MICH.] ADANS., AECIDIUM PERS. IN GMEL., AND ROESTELIA REB. — IR pp. 126–7; IRA p. 40.

Under the Rules all three proposed nomina rejicienda are already rejected — *Puccinina* Adans. 1763 under Art. 20(e) as antedating Persoon's *Synopsis*, the starting-point of nomenclature for rusts, and *Aecidium* and

Roestelia under Art. 57, as applying to imperfect states (cf. Rogers 1948). The proposal should be rejected, and revived for consideration only if Art. 20 or Art. 57 is so modified as to alter the status of *Gymnosporangium*.

HENDERSONIA SACC. vs. SPOROCADUS CORDA — IR p. 125; IRA p. 40; BMS 2 p. 291.

There is no such genus as *Hendersonia* Sacc. (see notes under *Acrothecium* and *Stagonospora*). On the showing of the B.M.S. committee the type species of *Hendersonia* Berk. is not congeneric with any of Corda's species of *Sporocadus*. The proposal should be rejected.

HERICIUM PERS. vs. HERICIUM FR. — Donk 1941 pp. 157, 169.

Like Donk's proposal concerning *Gomphus* vs. *Gomphora*, this arises out of uncertainty whether *Myc. Eur. 2* was published before or after *S.O.V.* Like *Gomphus* (q.v.), *Hericium* Pers., proposed for conservation, is valid without conservation (1) because (l.c.) it antedates the proposed nomen rejiciendum, and (2) because, as *Hericium* Pers. ex Gray, Nat. Arr. **1:** 652. 1821 (having the same type as the one proposed), it long antedates both 1825 publications. The proposal should be dropped.

HEXAGONA FR. vs. SCENIDIUM (KLOTZSCH) OK. — IR p. 123; IRA p. 40; BMS 3 p. 288; Donk 1941 p. 187.

The accounts of the history of *Hexagona* given in BMS and by Donk (l.c., and 1933 p. 129) differ in a number of points; and it appears that a fresh recapitulation is in order. Since *Hexagona* and *Favolus* have all along been confused (and in fact interchanged by Fries) the history must include both names. *Favolus* Palis. was published in 1804 for *F. hirtus*; later Palisot added *F. glaber* and *F. tenuiculus*; those publications are of course pre-Friesian and invalid. Fries published "*Favolus* Pal." as a subdivision (presumably subgenus) under *Polyporus*, in Syst. Mycol. **1:** 342. 1821; in it he included twelve species, including two of Palisot's. It is submitted that since he cited Palisot as the author of the name, the type of the subgenus should be chosen from those Palisot species which Fries included in it — i.e., *P. tenuiculus* (Palis.) ex Fr. and *P. hirtus* (Palis.) ex Fr. In S.O.V. 76. 1825 Fries stated that in discussing *Favolus* for the *Systema* he had seen no specimens, and had subjoined it to *Polyporus*, from which he later knew it to be quite diverse; he then gave a list, headed "sequentes videntur genuinae species." The list includes eight names, of which only four were included in the subgenus; two of the four are *F. tenuiculus* and *F. hirtus*, and since they and the genus are still attributed to "P B" — i.e., Palisot de Beauvais — it is evident that the genus is not new, but the former subgenus elevated in rank, and that no change in typification is admissible. In Elenchus **1:** 44. 1828 Fries again discussed *Favolus*, repeating much of what he had said in S.O.V., and writing also ". . . nomen genericum supervacaneum hoc loco servo. . . . Unicam modo speciem vidi [*F. brasiliensis* (Fr.) Fr. = *Daedalea brasiliensis* Fr., S.M. **1:** 332 = *Merulius daedaleus* Lk.]." Since Fries here referred the name to

S.O.V., and by using it refuted his assertion that it was "superfluous," this passage can, it would seem, have no effect on the standing of *Favolus*.

Hexagona was published in Fl. Scan. 339. 1835, in a key to the Polyporei providing ample characters for a description. A part of that key reads as follows: "3) alveolares, hexagoni, jam primitus ampli a) suberosi, ascis imperfectis = *Hexagona*, b) lenti, ascis perfectis didymosporis = *Favolus*." When Fries next discussed *Hexagona*, in Epicr. 496–498. 1838, he wrote, "Hoc et sq. genus [Favolum] sub Favolo comprehendit *Palisot*." Of the species that both Palisot and he had comprehended in *Favolus* one remains a part of that genus in the *Epicrisis*, *F. tenuiculus* Palis.; the other becomes *Hexagona hirta*. Thereby Fries himself established the typification of *Favolus*, by *F. tenuiculus*, in so doing following the indications of his key: for *H. hirta*, which should be "suberos[a]," is characterized by "pileo suberoso" in S.M., and *F. tenuiculus*, which should be "lent[us]," has a pileus merely "coriaceo" in S.M. and "*submembranaceo*" in Epicr.

The type of *Hexagona* is not so easily determined. In his discussion of the proposals for conservation Donk writes "[The type of *Hexagona*] should be *Favolus hirtus* Beauv. . . . and not *H. apiaria* (Pers.) Fr. The latter species was incorporated by Fries later on (Ep. 497. 1838). It was not among Fries' original species!" Donk's citation of p. 129 of his 1933 paper does not make this statement more comprehensible. Donk agrees that *Hexagona* was published by Fries in Fl. Scan., where no species are listed, and that his next treatment is in *Epicr.*, where twelve species are described in the genus. How then could one of these twelve have been "incorporated by Fries later on," or be "among Fries' original species" less than any other? Normally, since *Hexagona* is attributed in *Epicr.* (but not in the earlier *Fl. Scan.*) to Pollini, one would seek for the lectotype a Pollini species — in this case, *H. Mori*. But of that species Fries wrote, "Haec, sola Europaea, mihi ignota est," whereas some of the others he himself had described. There would seem to be little obligation to recognize *H. Mori* as the type, especially since the genus should be written *Hexagona* Fr. 1835. Any species treated as a *Hexagona* in the *Epicrisis* which agrees with Fries's original description (as *H. Mori* does not) can be designated as lectotype, and the B.M.S. committee, Clements & Shear (who suggest *H. crinigera*) or Donk may equally well be followed.

As to conservation: It is obvious from the proposal that that is unnecessary. Another vote is here added to those of Donk and the B.M.S. committee for rejecting the motion.

HIRNEOLA FR. 1849 VS. HIRNEOLA FR. 1825 and LASCHIA FR. — Donk 1941 p. 157, 170.

The proposal is based on the assumption that there are two distinct and independent genera *Hirneola* Fr. *Hirneola* was published by Fries in S.O.V. 93. 1825; by reference to Syst. Mycol. **2:** 161. 1822 it was erected for *Peziza flava* Sw. ex Fr. In 1849 Fries published an extended description

of "Hirneola. *Fr. Syst. Orb. Veg. p.* 256." (K. Vet. Ak. Handl. **1848:** 144.), and descriptions of sixteen species. Since he not only omits all mention of *P. flava*, even under the heading "Reliquae hujus [generis] species sunt: . . .", but designates another type, he clearly implies that he no longer considers it a part of the genus. This would seem to be a case of "exclusion of the type" (see remarks under *Phoma*). If it is such, there can be only one result, that prescribed by Art. 18: "The name of a group must be changed if the type of that name is excluded." There is nothing in the Rules to justify citing *Hirneola* Fries 1849 as a different name from *Hirneola* Fr. 1825.

The name *Hirneola* as Fries used it in 1849 and as it has subsequently been used by various mycologists is applied to fungi like *Auricularia* except that "the hymenial layer is superior" (Fr. 1849 p. 144). As Martin (1943 p. 80) and others have pointed out, and as anyone situated where auriculariaceous occur can confirm, this upside-down auriculariaceous genus is a myth. Whatever is to be said of the designated, but inacceptable, type *Peziza nigricans* Sw. (reported by its author to occur "on the ground"), the lignicolous *Hirneola nigra* ("Swarz") Fr. has an inferior hymenium, in this not differing from *Auricularia*. *Laschia* is similarly not properly distinguishable from *Auricularia*. Since *Hirneola* 1849 is therefore a nomenclatorial nonentity, and any renaming of Fries's 1849 concept would be taxonomically superfluous, there is neither need nor possibility for conservation. The proposal should therefore be rejected.

HYDNUM FR. VS. DENTINUM GRAY — Donk 1933 pp. 13–15.

There is no question whatever, in the mind of the author of this proposal or of anyone else, that if *Hydnum* and *Dentinum* are synonymous (as implied by the proposal) *Hydnum* will stand. There is therefore no occasion, under Art. 21, for the proposal, and it is here recommended that it be rejected.

This legalistic position is taken not out of perversity but on principle. The proposal in question, like a number of others, is a disguised attempt to gain the approval of a commision or the Congress for a particular typification. Banker (Torrey Bot. Club Mem. **12:** 104. 1906), working under the American Code, typified *Hydnum* L. by *H. repandum*, making *Dentinum* an obligate synonym. Miller (Mycologia **25:** 298–299. 1933), working under the International Rules, typified *Hydnum* L. ex Fr. emend. Gray by *H. imbricatum*, making *Sarcodon* Karst. a synonym. Now Gray must be considered the first post-Friesian author to restrict the originally inclusive genus *Hydnum*, and as such his decision is cogent if not irrevocable. Donk, l.c., treating Gray's work as pre-Friesian, typified *Hydnum* as did Banker. Since it has been shown (Mycologia **33:** 568–570. 1941) that Gray is post-Friesian, it may be that Donk would no longer support the proposal under discussion. It is a fact that he has not repeated it in his more recent (1941) more exhaustive consideration of nomina conservanda. What is of greater importance to the present discussion, how-

ever, is that for a considerable number of mycologists *Hydnum* Fr. and *Dentinum* Gray are not synonymous, that by the normal operation of the Rules they do not become synonymous, and that only by a special act of the Congress (the proposal under discussion) establishing a type species in opposition to "established custom" (which must recognize Gray's emendation) is there touched off a conflict between these names.

Since the past Congresses have deferred the adoption of a text for Appendix I, "Regulations for determining types," there are at present no rules for deciding in which sense *Hydnum* is to be held. There is, of course, "established custom," and in this case it is probably sufficient. But conservation is supposed to result in "a list of names which are to be retained as exceptions." Where there is no rule there can be no exception. It is absurd for a committee or a Congress to vote to make an exception of *Hydnum* when no one can say authoritatively what *Hydnum* is. It is absurd for two reasons: (1) Questions like this of the typification of *Hydnum* should be settled by consultation of experts — like Donk and Miller — and not by majority vote of the inevitably uninformed. (How many votes at the next Congress will be allotted to students of the Hydnaceae?) (2) The rules — i.e., Appendix I — should first be adopted, and afterward, if necessary, the exceptions.

HYMENOCHAETE LÉV. vs. STEREUM FR. and HYMENOCHAETA BEAUV. — Donk 1941 pp. 157, 171.

This proposal is offered on the supposition that "Fries (. . . 1825) was the first to publish validly the name *Stereum* as a generic one . . .". Actually, as shown later in these notes, under *Stereum*, *Stereum* Pers. ex Gray 1821 antedates Fries's use of it as a generic name. And since the 1821 genus can be typified by *S. hirsutum*, Gray's publication preserves the name in its present sense. Whatever can be said of *Stereum* Fr. 1825, it is at most a later homonym of *Stereum* Pers. ex Gray, and cannot interfere with the retention of *Hymenochaete* Lév.

The author notes that *Hymenochaeta* Beauv. is probably not to be regarded as a homonym of *Hymenochaete* Lév., but that previous to the publication of the latter name Nees used, for the former, the incorrect spelling *Hymenochaete*. He regards this as intentional, and as valid publication. He would then conserve *Hymenochaete* Lév. 1846 against *Hymenochaete* Beauv. ex Nees 1834. In the absence of evidence to the contrary, it seems less troublesome to consider "*Hymenochaete*" in Nees an erroneous printing of *Hymenochaeta* Beauv. — to whom Nees attributes the name. In that event, no conservation is necessary; the proposal should be rejected.

HYMENOGRAMME BERK. & MONT. vs. ASCHERSONIA ENDL., JUNGHUHNIA CORDA, and LASCHIA JUNGH. — IR p. 123; IRA p. 40; Donk 1941 p. 188.

Donk points out that there is no good reason to suppose *Hymenogramme* synonymous with the proposed nomina rejicienda, and that the genus is in

any case not of sufficient consequence to be worthy of conservation. He implies that the proposal should be rejected; and that action is recommended here also.

HYMENULA FR. vs. HYMENELLA FR. — IR p. 126; IRA p. 40.

According to Fries's own reference (Elench **2:** 37. 1828) *Hymenula* is merely an altered spelling of *Hymenella*. If it were a different genus it would be, l.c., a nomen nudum, since no generic diagnosis is given. It seems pointless to conserve a name in order to retain a particular spelling. Conservation can have no other effect, since *Hymenula*, being a mere renaming of *Hymenella*, must have the same type as that genus. The normal procedure would be to designate *H. vulgaris* Fr. as the type; the proposed lectotype, *H. rubella*, not one of the original species of *Hymenella*, is not elegible. The proposal should be rejected.

HYPOCHNUS FR. vs. LYOMYCES KARST. — IR p. 123; IRA p. 40; Rogers 1939; BMS 1 pp. 224, 232; Donk 1941 p. 188.

The numerous inaccuracies in the proposal are discussed in the various places here listed. Briefly, it seems to be agreed that *Hypochnus* Fr., Syst. Mycol. **3:** 289, is a genus of lichens; that there are so many conflicting "interpretations" of that name that *Hypochnus* is a nomen ambiguum; and that the proposal should be rejected. See notes under *Tomentella*.

HYPOLYSSUS BERK. vs. PERONA FR. and CARIPIA OK. — Martin 1938 p. 440, 1948 p. 113; Donk 1941 p. 195; Ainsworth & Bisby 1943 pp. 144, 217, 1945 pp. 155, 232; Doty pp. 126, 133.

Martin does not explicitly propose conservation of the name *Hypolyssus*, but writes (l.c.) "a good case could be made for the conservation of *Hypolyssus* in Berkeley's sense." It appears of some interest to examine that case here.

Hypolyssus was originally published by Persoon for two species which in all probability were agarics parasitized and distorted by *Hypomyces* (for reference see under nomina confusa). The generic and specific names which he used are then without much doubt nomina confusa, automatically rejected under Art. 64. (See under *Hypomyces*). *Hypolyssus* appears never again to have been used for the fungi on which Persoon based it. Berkeley (Lond. Jour. Bot. **1:** 139–140. 1842), after a description of a wholly different fungus, wrote "As Persoon's genus *Hypolyssus* is altogether effete, and its characters are very like those of the plant before us, I have thought it advisable to restore it"; in consequence he described *Hypolyssus Montagnei* under *"Hypolyssus, Pers."*

Since Berkeley explicitly was using "Persoon's genus" the only justification for citing a genus *Hypolyssus* Berk. would have to arise out of Art. 47, which, as modified at Amsterdam (see citations and discussion under *Phoma*), may be interpreted as permitting such citation if 1) the diagnostic characters or circumscription are altered and 2) the type is excluded. It is

submitted that although Berkeley gave an essentially new description of *Hypolyssus*, he did not alter its diagnostic characters, since he wrote, "Its characters are very like those of the plant before us," and that he did not alter its circumscription except to enlarge it as anyone enlarges a genus who adds a new species to it. It is submitted also that he did not exclude the type; in fact, he did not directly or by implication so much as mention the species already belonging to the genus. He "restored" the name of a genus "altogether effete" — much as was done with *Patouillardina* in Mycologia **28:** 398. 1936, and with the species *Chrytridium Saprolegniae* (see discussion under *Olpidiopsis*). Since there was neither alteration of diagnostic characters nor exclusion of type, there is no *Hypolyssus* but *Hypolyssus* Pers., a nomen confusum.

There are two names which appear to have been validly published for the genus exemplified by Berkeley's fungus, *Podostrombium* G. Kunze ex Lév., Considerations Mycologiques p. 119. 1846 ("Extrait de" d'Orbigny, Dict. Univ. d'Hist. Nat. **8:** 491. 1847), and *Caripia* OK., Rev. Gen. Pl. **3**(2): 451. 1898. The whole reference to *Podostrombium*, l.c., is as follows: "*Podostrombium*, Kz. = *Hypolyssus Montagnei*, Berk." This clearly does not include more than a minimum of what is requisite for valid publication; but it seems not unreasonable to read it as 1) a new name, *Podostrombium*, 2) substituted for *Hypolyssus* as described by Berkeley [the description having been effectively published] 3) for *H. Montagnei*. The name *Podostrombium* G. Kunze had been in the literature long before 1846, but seems not to have been previously published. Since both *Podostrombium* and *Caripia* were explicitly substitutes for *Hypolyssus* sensu Berk. non Pers., there is no doubt of the synonymy. Two other names sometimes cited as synonyms have less claim to that status. One is *Heringia* Schw. in sched. ex B. & C., Acad. Nat. Sci. Phila. Jour. ii **2:** 279. [1853] & **3:** 205. 1856 (pro synon.), nec *Heringia* Agardh; since it was published only in synonymy, it is obviously a nomen nudum. The other is "*Perona* Fr." which similarly is a nonentity. Fries wrote (Summ. Veg. Scand. 333. 1849) "Perona *Berkl. in Hook. Lond. Journ. 1 p. 39.* Pileus suberosus, hymenio laevissimo rimoso."; and in his index, p. 568, "Hypolyssus B. (Perona)." But it is only by a set of curious circumstances that the name *Perona* ever came to be used in this connection. For it is not a Berkeleyan genus, nor a Friesian, but a Persoonian, published in Mycol. Eur. **2:** 3. 1825. Fries seems to have had a general idea that Berkeley had revived one of the small genera from Persoon's Mycol. Eur., but to have picked out the wrong name, cited the wrong page for Berkeley's publication, missed the diagnosis given by Berkeley (Fries wrote "quatenus hoc genus sine caractere generico l. c. propositum . . ."), and finally tried to make amends in the index to the Summ. Veg. Scand. In any case, it is not *Perona* Fr. (as cited by Saccardo, Syll. **6:** 521. 1888), but "*Perona* Pers. erroneously ascribed to Berkeley by Fries."

That leaves, then, the matter of conservation of *Hypolyssus* Berk. Donk's remark is to be heartily approved: "It seems not necessary to

propose *Hypolyssus* 'Berk.' as a nomen conservandum, since there is a good other generic name available [Donk lists both] and also because the genus includes only 1 or at most 2 species!" Dr. Martin writes that *Podostrombium* is acceptable to him.

HYPOMYCES TUL. vs. HYPOLYSSUS PERS. — IR p. 121; IRA p. 40; Bisby p. 102.

As pointed out by the eminent O. Kuntze (Rev. Gen. Pl. **3**(2): 487. 1898), by Martin (1938, p. 440), and probably by others, *Hypolyssus* Pers. (q.v.) was based on specimens of Agaricaceae overgrown and distorted by *Hypocrea* or *Hypomyces*. On these grounds Kuntze sought to use the name *Hypolyssus* for *Hypomyces*. But under the Rules the name *Hypolyssus* Pers. must be rejected as a nomen confusum (Art. 64). In consequence it cannot interfere with the use of *Hypomyces* Tul. and the proposal is unnecessary. It should be rejected.

HYPOSPILA (FR.) FR. vs. PHOMA FR. — IR p. 121; IRA p. 40; BMS 3 p. 284.

This, one of the most extraordinary proposals (at least in reference to fungi) to come before the Congress, is summarized well, if mildly, by the B.M.S. committee. What, if anything, was supposed to be the meaning of the citation "*Hypospila* Fr. [Syst. Orb. veg. (1825?) 109], Summ. Veg. Scan. (1849) 421" remains a mystery; *Hypospila* is published in both places as a genus. In addition, in both places Fries designated the type of his genus: "*Typus est Spiloma inustum* Ach.," and "Typus *Sph. inusta* El." [**2:** 88. 1828, based on *Spiloma inustum* Ach.] If *S. inustum* is a nomen dubium, as Petrak & Sydow declare (Ann. Mycol. **21:** 369–371. 1923), the only possible consequence is that the name *Hypospila* is also a nomen dubium, to be rejected under the Rules as by Petrak & Sydow. It is therefore all the more surprising that the proposal is made to recognize as the type of *Hypospila* the species *Phoma pustula* Pers. sub *Sphaeria* ex Fr., Syst. Mycol. **2:** 547. 1823, the designated type of *Phoma* Fr., Novit. Fl. Suec. 80. 1819, and a species which Fries never acknowledged as a *Hypospila*. It is as though one were to propose *Agaricus campestris* as the type of *Hypospila* and as a consequence the conservation of *Hypospila* vs. *Agaricus*. The B.M.S. committee has recommended the rejection of the proposal, and that recommendation is here seconded. See later notes under *Phoma*, and on *Hypospila* among nomina confusa.

LACHNOCLADIUM LÉV. vs. ERIOCLADUS LÉV. — Donk 1941 pp. 157, 173; Doty p. 130.

Donk infers that Léveillé, following a homonym rule of his day, substituted *Lachnocladium* for his *Eriocladus*, and was followed in this by all mycologists. Since his homonym rule is not ours, *Eriocladus* is again valid, unless made a nomen rejiciendum by formal conservation of the synonym.

Dr. M. S. Doty notes (in a personal communication, more recently published by him) that with the exclusion of species not congeneric with the

type of *Lachnocladium* (and *Eriocladus*) and the necessary reduction of nearly all others to synonymy with the type, the genus becomes very small, probably too small to justify the conservation of the name. Furthermore, for the genus in such a restricted sense the name *Lachnocladium*, generally understood in a much broader sense, is actually a source of confusion. It is therefore here recommended that *Lachnocladium* not be conserved, and that the valid *Eriocladus* be allowed to stand.

MACOWANITES KALCHBR. vs. MACOWANIA KALCHBR. APUD BERK. and HYPOCHANUM KALCHBR. — Ramsbottom 1942.

Of the synonyms listed *Macowania* must in any case be rejected as a later homonym. On Ramsbottom's showing *Hypochanum* was the earlier published of the remaining names and is valid. Zeller & Dodge (Mo. Bot. Gard. Ann. **23:** 636–638) recognize only two species in the genus, which is not otherwise important. On the principle of refraining from interference with the operation of the Rules except in important cases, it would be well in such a minor case as this to reject the proposal. Dr. S. M. Zeller reports (in Mycologia **40:** 643. 1948) his rejection of *Macowanites* (= *Hypochanum*) as an autonomous group; *M. agaricinus*, the genotype, is "an aberrant agaric belonging perhaps to *Russula*."

MARASMIUS FR. vs. MICROMPHALE GRAY — Singer & Smith 1946 pp. 252, 255, 295.

The proposal is for what the authors (p. 294) call conditional conservation — i.e., if an author holds the two genera to be synonymous, *Marasmius* is to be retained; if he considers that *Micromphale* constitutes a genus distinct from *Marasmius*, both names are to be available. Except for names which are obligate synonyms — i.e., have the same type — that seems to be the nature of all conservation. For conservation is provided "to avoid disadvantageous changes in the nomenclature of genera," and the conserved names are "retained as exceptions" (Art. 21). Where there would be no disadvantageous changes — as where *Marasmius* and *Micromphale* are held to be the names of taxonomically distinct genera — any conservation is automatically inapplicable; or, to put the same thing another way, where the name *Marasmius* would not be retained as an exception — as, again, where there are held to be two distinct genera — conservation is inoperative. The Rule for conservation (like many others) is essentially a footnote to Art. 16: "Each group with a given circumscription, position and rank can bear only one valid name"; conservation provides exceptions in the manner of deciding upon that one name. But where there are more groups than one, there can and must be more names. In these notes it has occasionally been recommended, as under *Plowrightia*, that a motion for conservation be rejected on the grounds that the names are not synonymous. Such recommendations are made not on the supposition that conservation would in such a case alter the status of either name in the least, but only to avoid useless expansion of the list of nomina conservanda, and the confusion resulting from the incorrect implication that the names in-

volved are synonymous. On the other hand, the proposal to conserve *Tomentella* vs. *Caldesiella* (q.v.) was just such a conditional proposal as that for conserving *Marasmius*, and has been accepted by the B.M.S. committee and by Donk as well as by its author. It is recommended that the present proposal be adopted.

MARSSONINA MAGN. VS. MARSONIA SACC. and MARSSONIA FISCH. NON KARST. — IR p. 125; IRA p. 40; BMS 2 p. 291.

Since *Marssonia* Fisch. is a hyponym it need not be conserved against; furthermore, as the name originally appeared in Rabenh. Fung. Eur. it was (according to Magnus, Hedw. **45:** 88. 1906) a nomen nudum, and apparently was first validly published ex Allesch. in Rabenh. Krypt.-Fl. 2 Aufl. **1** (**7**): 595. 1902. Since Saccardo had already published the name (with altered spelling) in 1880, attributing it to Fischer, *Marssonia* Fisch. is not only a hyponym but a later orthographic variant of *Marsonia* Fisch. ex Sacc. It seems clear that *Marsonia* is, under Art. 70, last paragraph of "Examples," a "mere orthographic variant" of *Marssonia*, and therefore, like that spelling, a hyponym of Karsten's name. *Marssonina* therefore stands without conservation. The proposal should be rejected.

MASSARIA NOT. VS. SPLANCHNONEMA CORDA — IR p. 121; IRA p. 40; BMS 3 p. 285.

The typification recommended by the British committee is "*M. inquinans* de Not. nec *Sphaeria inquinans* Tode ex Fr." Since *M. inquinans* Not. is based on *S. inquinans* Tode ex Fr., this proposal is contrary to Art. 54 as amended at Amsterdam (Zesde Int. Bot. Congr. Proc. **1:** 347, 354. 1936; Science **83:** 417, 1936; omitted in IRB p. 85 and IRA p. 20): "When on transference to another genus, the specific epithet has been applied erroneously in its new position to a different plant, the new combination must be retained for the plant on which the epithet was originally based and must be attributed to the author who first published it." Therefore, whatever de Notaris had in hand, the monotypic genus *Massaria* was based on *M. inquinans* (Tode ex Fr.) Not.; there is no other *Massaria inquinans*.

On the showing of the British committee it is far from certain that *Splanchnonema* is synonymous with *Massaria*. In view of the uncertainty concerning their identity, it seems not proper to conserve the one genus against the other. The proposal should be rejected.

MASTOMYCES MONT. VS. TOPOSPORA FR. — IR p. 125; IRA p. 41; BMS 2 p. 289.

The case for conservation of *Mastomyces* presented in BMS appears entirely acceptable except that only two species belong to either genus. Since the genus is small and of no particular importance (especially since one of these specific names, "of only temporary value" — Art. 57, par. 2 —, must give way to the name *Godronia urceolus*), it is recommended that the proposal be rejected, along with those listed on a later page under *Tremellodon*.

MELAMPSORA CAST. vs. UREDO PERS. — IR p. 126, 127; IRA p. 41; Rogers 1948.

Since *Uredo* is already rejected by Art. 57, and by the examples thereunder, as a name applied to an imperfect state (cf. Rogers), the proposal is unnecessary and should be rejected.

MELANOGASTER CORDA vs. UPERHIZA BOSC, HYPERRHIZA SPRENG., ARGYLIUM WALLR., OCTAVIANIA VITT., and UPERRHIZA FR. — IR p. 124; IRA p. 41; Zeller & Dodge p. 640; Cunningham p. 47.

Melanogaster was published in a place not easy to cite: Sturm, Deutschl. Flora III Abt. 3 Bändchen. 11 Heft: 1. 1831. The title page for the "Bändchen" bears the year 1837; the several included "Hefte" were, however, published at different dates, each with its own colored-paper cover; and that for 11 Heft is dated 1831. The citation here given (which differs from those printed in the Rules and in Zeller and Dodge) and the date 1831 (six years earlier than that given for the genus in the Rules) should be used.

Zeller & Dodge state that *Uperhiza* Bosc. (and the variant names *Hyperrhiza* and *Uperrhiza*) may well have been based on a *Scleroderma* rather than a *Melanogaster*; these names can then be rejected as nomina dubia or ambigua, without the formality of conservation. *Argylium* was published in 1833, and therefore is antedated by *Melanogaster*. Apparently then of the listed names the only rival to *Melanogaster* is *Octaviania*, which likewise was published in 1831. It is asserted in the proposal under consideration (and the accompanying one for conservation of *Octaviania*, q.v.) that six of the seven original species of *Octaviania* are species of *Melanogaster*. Zeller & Dodge list *O. ambigua*, *O. rubescens*, and *O. variegata* as accepted and *O. sarcomelas*, *O. odoratissima*, and *O. aurea* as doubtful members of *Melanogaster*; they exclude *O. asterosperma* from consideration as the type of *Octaviania* (Mo. Bot. Gard. Ann. **23:** 603) and designate *O. variegata* as its lectotype. Since *O. variegata* is a species of *Melanogaster*, if their choice be accepted the two genera are synonymous. In that event it would be important to know which was the earlier published; and no evidence on this point is at hand.

As early as 1842 Corda wrote "*Octaviania asterosperma* dürfte die eigentliche Grundform dieser Gattung [*Octaviania*] bilden" (Anleitung 107). It is submitted that thereby he designated the type of the genus. And since it is "established custom" that the first author to designate a lectotype is to be followed (unless, of course, his selection is opposed to cogent indications for another typification, or to exclusion of the lectotype by some earlier student), Corda's decision is entitled to respect. That is true even though it be suspected that his motive was to save *Melanogaster* from synonymy with *Octaviania*.

Zeller & Dodge (Mo. Bot. Gard. Ann. **23**: 603) write "the principle character which [Vittadini] emphasized was the dark color of the spores. . . . He specifically notes that *O. asterosperma* is aberrant in the genus

because of its sterile base and the shape of its spores . . ."; it is on these bases that they exclude *O. asterosperma* from consideration as the type. The words Vittadini used of his genus were "cellulae substantia compacta, demum in pultem brunneo-nigrescentem sporidiiferum fatiscente, repletae. Sporidia nuda ? varia. . . . Caro e sporidiorum colore subnigra." Thus although in the last sentence he explains the dark color of the glebal cavities ("cellulae") by the color of the spores, it is with the fact that they are filled with a "brownish-black pulp" that he is chiefly concerned. Of *O. asterosperma* Vittadini wrote: "Cellulae substantia primitus compacta, humida nigrescente, demum fuscoferruginea, subpulverosa, sporidiifera repletae." This does not depart greatly from the diagnosis of the genus; the glebal cavities of the species are brownish-black. It is true that the spores of *O. asterosperma* are described as "pallide-brunnea"; but those of *O. rubescens* are said to be "pellucida," and those of *O. variegata* "brunnescentia." Vittadini does not therefore mark spore-color as a point of aberration in *O. asterosperma*. And as to the second point, Vittadini does not note "that *O. asterosperma* is aberrant in the genus because of its sterile base and the shape of its spores"; he writes rather: "AFFIN[ITAS.]. Octav. rubescenti vicinus. Differt peridii colore, appendicis basilaris praesentia, ast praecipue sporidiorum forma." That is, it differs from the similar *O. rubescens* in those characters; not from the genus as a whole. It is submitted, then, that *O. asterosperma* is not excluded from consideration by the words of the author of that species, and that Corda should be followed in his designation of the type. If that be done, *Octaviania* (q.v.) is not a synonym of *Melanogaster*, since *O. asterosperma* is not a melanogaster.

Melanogaster has an earlier synonym *Bullardia* Jungh. 1830; nec *Bulliarda* Necker 1790. To judge from the "Examples of orthographic variants" given under Art. 70, these are different names. Since *Bullardia* has not been used since its publication, and *Melanogaster* has been continuously used for a genus of some size and importance, conservation should probably here be employed. The proposal in the Rules is, however, in error in still another point: *M. variegatus* (Vitt.) Tul. 1843 obviously cannot be the type of *Melanogaster* Corda 1831; that genus is monotypic, and its type is *M. tuberiformis*. It is here recommended that the following proposal for conservation be adopted: *Melanogaster* Corda in Sturm, Deutschl. Flora III **3**: 1. 1831 — Type: *M. tuberiformis* Corda — vs. *Bullardia* Jungh., Linnaea **5**: 408. 1830.

MONILIA BON., Handb. Allg. Mykol. 76. 1851 — Type: *M. candida* Bon., l.c. — vs. MONILIA PERS., Mycol. Eur. **1**: 29. 1822; HILL EX FR., Syst. Mycol. **3**: 409. 1832. — Dodge p. 195; Conant pp. 260–265; Ainsworth & Bisby 1943 p. 185, 1945 p. 199.

Dodge does not offer a complete proposal, l.c., but the statement here given is drawn from the details of his discussion except for the citations of the *Monilia* to be rejected, which he does not supply. It must be noted

(1) that *Monilia* is not claimed by Bonorden, but is written by him "Monilia. Hill-Fries. Fries Systema mycol. III, p. 409," and (2) that while the second of the two species described by Bonorden, "*Monilia cinerea m.*" is Bonorden's (the "m." standing for a possessive expression, presumably "mihi"), *M. candida* is not so signed and is by implication the species of some other author, quite certainly Persoon. The genus as treated by Bonorden should then be cited as "*Monilia* Hill ex Fr." (of which the type designated in Syst. Mycol. **3**: 409 is *Mucor caespitosus* L. — i.e., *Monilia digitata* Pers. ex Fr., p. 411); since there is no *Monilia* Bon., it does not matter whether a "sensu Bon." is added to the citation or not.

M. cinerea Bon. "kommt auf faulenden Früchten vor," and is without much doubt the imperfect state of a species of *Sclerotinia* (or *Monilinia*). *M. candida* sensu Bon. "bildet ein wolliges, eine Linie hohes Hyphasma auf faulem Holz"; until one of the fungi of the laboratory or clinic still sometimes referred to as "monilias" is found in nature "forming a woolly mycelium on rotten wood," the fungus Bonorden was describing must be thought a good deal closer to *Monilia* Pers. and *M. candida* Pers., Mycol. Eur. **1**: 29, 30, 1822, than to the monilias of the medical man and bacteriologist. (Note that *M. candida* Pers. is nowhere, by Persoon or Micheli whom he cites, said to have the inflated conidiophore of *Aspergillus*). In brief, there is no *Monilia* Bon. to conserve, and if there were neither of the species which he treated under that name would permit its use for *Monilia* sensu medicorum.

Finally, the name *Monilia* has for so long been so generally attached to various more or less byssoid Moniliaceae that its use for other forms is certain to result in ambiguity and confusion — as in the paper on the genus by Shrewsbury in Jour. Path. Bact. **38**: 313–354. 1934. Because "*Monilia* Bon." is non-existent and inapplicable, and because its employment must occasion confusion, it is here recommended that the proposal be rejected.

Ainsworth & Bisby write "conservation for sp. such as *M. cinerea* Bon. is probably needed." The question of the correct application of the name *Monilia* is thereby brought before the meeting. Its answer depends not only on the answer to the starting-point controversy, but also on the interpretation of the species ascribed to the genus by Persoon and Fries. It appears that at least some of the species of Persoon belong to *Monilia* in a sense quite generally accepted. But because of the dates, it is obviously impossible for *M. cinerea* Bon. to have been included in *Monilia* by either Persoon or Fries. And *M. fructigena* Pers., Syn. 693, which would be equally acceptable, in Persoon's first post-1821 work appears in *Acrosporium* and in Fries's Systema in *Oidium*. There seems to be no early work after the starting point for "Fungi caeteri" in which this species forms a part of *Monilia*. Probably, then, the proposed typification cannot be established. Perhaps the alternative offered by Dodge, "to disregard the name altogether," would be best as well as easiest; the best-known names,

at least, should be displaced by the name of their perfect stage (e.g., *Sclerotinia*, *Monilinia*, *Neurospora*) or have been transferred to other genera (e.g., *Oidium*). Probably *Monilia* could be retained for any light-colored fungus only if conserved against *Monilia* Link ex Gray, Nat. Arr. **1:** 557. 1821 (Dematiaceae). *Monilia* Moench ex Gray, Nat. Arr. **2**: 110. 1821. (Gramineae) is an altered spelling of *Molinia* Schrank, Baier. Fl. 100. 1789; Moench, Meth. Pl. Marburg. 183. 1794; and since it is clearly inadvertent (Gray writes "Monilia" in citing both Schrank and Moench) presumably has no nomenclatorial standing.

Conant discusses the history and application of various names thought applicable to *Monilia* sensu medic., giving the opinion that "*Syringospora* Quinquaud was the first validly published genus" for them, but making no specific recommendation for conservation. Ainsworth & Bisby (1943 p. 47, 1945 p. 52) write "Conservation [of *Candida*] possibly necessary."

MONOTOSPORA SACC. VS. MONOTOSPORA CORDA — Mason 1941 p. 103.

This is another proposal to sanctify an obvious misapplication by the invention of a new genus to be conserved against one long established (see notes under *Acrothecium*). What this motion entails is to father on Saccardo (1880) a generic name published by Corda (1837) and to typify it by a species attributed to the genus by Berkeley & Broome in 1859. One must wonder "Why Saccardo?" It is recommended that the example of Saccardo be followed in writing "*Monotospora* Corda," and that since there is no *Monotospora* Sacc. the proposal be discarded. Ainsworth & Bisby (1943, p. 187) list *Monotospora* as a nomen confusum, but without reference or evidence.

MONTAGNITES FR., Epicr. 240. 1838 — Type: *Agaricus arenarius* DC., Fl. Fr. **6**: 45. 1815 — vs. MONTAGNEA FR., Fl. Scan. 339. 1835; Gen. Hym. 7. 1836. — Morse.

Having twice published the name *Montagnea*, Fries then altered it to *Montagnites* because DeCandolle by changing the generic name *Montanoa* Cerv. apud Llave & Lexarza, Nov. Veg. Descr. **2**: 11. 1825, to *Montagnaea* DC., Prodr. **5**: 564. 1836, had created an approximate homonym. As Montagne first (Syll. Gen. Spec. Cryptogam. 129–130. 1856) and Zeller most recently (Mycologia **35**: 418. 1943) pointed out, *Montagnea* Fr. as published in the Gen. Hym. antedates *Montagnaea* DC. by half a year, and *Montagnaea* is in itself invalid, being a superfluous name for *Montanoa*. Furthermore, *Montagnea* Fr. was published even earlier, in 1835, and in any case the names *Montagnea* and *Montagnaea* are not homonyms, differing as they do in spelling, in pronunciation, and in derivation (the person commemorated). In first describing *Montagnea* Fries enumerated no species; in 1836 he named one, *A. arenarius*, as an example of the genus; that then should be taken as the type, both of *Montagnea* and the substituted name *Montagnites*.

The author proposes the conservation of *Montagnites* on the grounds

that "*Montagnites candollei* was promptly adopted in all the literature." As noted, Montagne himself, whose name was to be immortalized in one generic name or the other, used *Montagnea*, and protested against the altered form; *Montagnea* was also used in Corda, Icones **6**: 85. 1854. Since the termination *-ites* is so usefully employed as the indication of a genus of fossils, its use for a living group is anomalous and misleading. A name formed with that termination cannot be rejected on that account, but when it is already clearly and abundantly invalid, it would appear better not to attempt special action to retain it. It is recommended that the proposal be rejected.

MUTINUS FR. VS. AEDYCIA RAF. and CYNOPHALLUS (FR.) CORDA — IR p. 124; IRA p. 41; BMS 2 p. 285.

The B.M.S. Committee has added a second nomen rejiciendum to the one proposed in the appendix to the Rules; and there is a third which must also be considered, *Ithyphallus* Gray (see also notes under *Phallus*). The proposal should read: *Mutinus* Fr., Summ. Veg. Scand. 434 (1849) — Type: *M. caninus* (Pers.) Fr., l.c. — vs. *Aedycia* Raf., Jour. Bot. Soc. Bot. [Desvaux] **1**: 222. (1808); *Ithyphallus* Gray, Nat. Arr. Brit. Pl. **1**: 675. 1821; and *Cynophallus* (Fr.) Corda, Icon. Fung. **5**: 29. 1842; Einleitung Stud. Mycol. lxxxv, 119, pl. E, 51, fig. 1–8. 1842. (The B.M.S. committee reports that "Corda [Icones] . . . did not make the binary combination"; but two binomials in *Cynophallus* appear in the *Anleitung*.) As by the British committee, it is here recommended that the proposal be adopted; this recommendation was approved also by Dr. S. M. Zeller.

MYCOBONIA PAT. VS. HIRNEOLA FR. — Donk 1941 pp. 157, 173, 170.

The author points out that *Mycobonia* and *Hirneola* 1825 (non *Hirneola* Fr. 1849, q.v.) are obligate synonyms. The genus is small and of no importance; nevertheless, *Hirneola* has been so widely used in its illegitimate application for auricularias with a "superior hymenium" that to allow it to stand in its legitimate application, for a hydnum-like fungus, would be to establish a nomen ambiguum, "a permanent source of confusion or error." *Hirneola* Fr. 1825 must then be rejected under Art. 62. The rejection of *Hirneola* Fr. does not, however, of itself permit the use of *Mycobonia*, since the latter name is illegitimate under Art. 60(1) as amended at Amsterdam (see citation in the discussion under *Sordaria*). *Grandinioides* Banker, Torrey Bot. Cl. Mem. **12**: 179. 1906, is another obligate synonym illegitimate for the same reason. The genus is quite small and of no particular importance; nevertheless, because it has no legitimate name at present, it is recommended that the proposal be adopted. The alternative is the publication of a new name.

MYCOLEPTODON PAT. VS. ODONTIA FR. 1835, 1836, nec ODONTIA PERS. EX BANKER 1929 — Donk 1941 pp. 157, 174.

Although the author of the proposal wrote "*Odontia* Fr. (non Pers.)," there must be some doubt whether there is a genus *Odontia* Fr. In Syst.

Mycol. **1**: 415. 1821 Fries cites *Odontia* Pers. as a synonym of his Trib. *Resupinatus* of *Hydnum*; in Fl. Scan. 340. 1835 he keys out a genus *Odontia*, but gives neither its author nor its species; in Gen. Hym. 13. 1836 he gives a diagnosis and designates a type species, *Sistotrema fimbriatum* Pers., again giving no author for the genus; in Epicr. 528 he gives descriptions of five species of *Odontia*, with no authority for the genus, but only a reference to "Gen. Hymen." Not until 1849, in Summ. Veg. Scand. 329, does he write the genus "*Odontia. Fr.* Hydni sp. *P.*[*ers.*]"; in Hym. Eur. 627. 1874 he similarly ascribes the genus to himself. It may be that by 1849 he had forgotten that in 1821 he had ascribed the genus to Persoon; but in view of that fact, and of the fact that the species which Fries designated as the type of *Odontia* was first published as *Odontia fimbriata* Pers., Obs. Mycol. **1**: 88. 1796, and is so cited in Pers. Syn. Meth. Fung. 553 under the name *Sistotrema fimbriatum* to which Fries refers in designating the type, it would seem that the genus as he used it should be cited as *Odontia* Pers. ex Fr. rather than as a brain-child of Fries. In addition, whether or not there is an *Odontia* Fr., Fries's first use of the name for an autonomous genus is long antedated by *Odontia* Pers. ex Gray, Nat. Arr. **1**: 651. 1821, of which it can at most be a later homonym.

The retention of Patouillard's name *Mycoleptodon* would not appear to be a matter of great importance. Donk, Nederl. Mycol. Ver. Med **18–20**: 190. 1931, makes it a synonym of *Gloiodon* Karst.; Miller, Mycologia **25**: 296. 1933, and Miller & Boyle, Univ. Iowa Studies Nat. Hist. **18(2)**: 45. 1943, make it a synonym of *Steccherinum* Gray; Bourdot & Galzin, Hym. France 440. [1928], include in it the type species of both *Odontia* and *Steccherinum*, so that as they use it the name must fall into synonymy under one or the other of those genera.

It is possible that at some future time action will have to be taken on the name *Odontia*. But it is greatly preferable that the taxonomy, and especially the delimitation of natural genera, within the non-stipitate Hydnaceae be first more greatly perfected. It is recommended that the proposal be rejected.

MYTILIDION SACC. vs. MYTILINIDION DUBY — IR p. 122; IRA p. 41; BMS 2 p. 284.

There is no *Mytilidion* Sacc.; Saccardo ascribed *Mytilidion* to Duby, and intended to do no more than correct Duby's faulty word-formation. As pointed out by the B.M.S. committee, this correction is forbidden by the Rules. It would appear that to make Saccardo's spelling sacrosanct would not "avoid disadvantageous changes in the nomenclature of genera" (Art. 21), and that in consequence this motion cannot be entertained under the provisions for conservation. The proposal should be rejected.

NIDULARIA FR. vs. GRANULARIA ROTH — IR p. 127; IRA p. 41; Bisby p. 106.

The proposal is to conserve a name published for a gasteromycete in 1818 against one published in 1791. Since under the International Rules

names published for gasteromycetes before 1801 have no standing in any case, the proposal must have been put forward under some other rules.

Granularia was published in Ann. Bot. (Usteri) **1**: 6. 1791, by Roth (and not, as stated in Gmel., Linn. Syst. Nat. ed. 13 **2**(**2**): 1487. 1796, by Willdenow). Its first use as a genus subsequent to 1801 seems to have been by Link, in Nees, Horae Phys. Berol. 6. 1820, who attributed it properly to Roth. Since *Nidularia* was published by Fries in 1818, there appears to be no need to conserve it. The proposal should be rejected.

NUMMULARIA TUL. vs. BISCOGNIAUXIA OK. — IR p. 121; IRA p. 41.

NUMMULARIA TUL. vs. NUMMULARIA GILIB. — IR p. 127; BMS 1 p. 219; Miller 1932 p. 131, 1941 p. 74.

Providing that taxonomists of vascular plants can do without *Nummularia* as employed by a few recent authors for a section of *Lysimachia*, and provided mycologists can properly employ the name, an excellent case on nomenclatorial grounds is presented in BMS for the conservation of *Nummularia* Tul. Since the generic name is taken from that of one of its species, *Hypoxylon nummularium* Bull., in the absence of typification by its authors it would be difficult to choose any other as the type species. The lists in IR and the discussion in BMS all consider *N. Bulliardi* Tul. (≡ *H. nummularium* Bull.) the genotype. Miller, however, who considers *N. Bulliardi* inseparable from *Hypoxylon* and *N. discreta* a member of an autonomous genus, lists the latter as the type of *Nummularia*. In their original publication of the genus the Tulasnes included the following (Sel. Fung. Carpol. **2**: 43): "*Nummulariae* characteres traximus ex *Hypoxylo nummulario* Bull. et *Sphaeria discreta* Schw. quae pro generis typis habere decet." The designation of two types for one name does not settle the nomenclatorial problem under discussion, but it does make possible a later selection; Miller's choice is no more excluded than is the alternative. The question is whether *N. discreta* and related forms are left without a generic name by the designation of *N. Bulliardi* as type; and this question is taxonomic rather than nomenclatorial. Miller's taxonomic conclusions will certainly be accepted by many mycologists. For these workers, if *N. Bulliardi* be designated as the type, *Nummularia* becomes a useless synonym of *Hypoxylon* and another generic name must be found for *Sphaeria discreta*. If the latter be designated as the type, *Nummularia* can be used both by those who consider the two species congeneric and by those who separate them. It is therefore recommended that *Nummularia* Tul., with the type *Sphaeria discreta* Schw., be conserved against *Numularia* Tragus ex Gray, Nat. Arr. **2**: 300 (p. 748 ut "*Nummularia*"). 1821.

The B.M.S. report recommends that the nomen rejiciendum be written *Nummularia* Gronov. Fl. Virg. ed. 2, 26 (1762). In the place cited is found "NUMMULARIA *aquatica Becabungae foliis*, ad genicula florens, flore albicante tubulato, caule rubente succulento, radice repente. *Clayt.*" Above it are found two lysimachias treated in similar fashion, and on the opposite page three azaleas so discussed. It is submitted that this is not

a generic description of *Nummularia*, any more than there are three generic descriptions of *Azalea* on the next page, but that it is a specific description of *Nummularia aquatica Becabungae foliis*. The fact that the quoted material is copied in 1762 without change except (erroneously) in type-face from the first edition of Gronovius, which is pre-binomial, bears this out. The page of Gilibert's work on which *Nummularia* is said to have been published is not at hand for examination; but since in the greater part of his Fl. Lituan. he describes only species, and not genera, it is tentatively assumed that he did not publish *Nummularia*. There seems to be no post-Linnaean publication of the generic name before 1821; and therefore it is here attributed to Gray, who validly published the genus. Other possible uses by early authors of *Nummularia* would automatically be rejected by this action. *Biscoigniauxia* Tul. would similarly be discarded without formal rejection.

OCTAVIANIA VITT. vs. OCTAVIANINA OK. — IR p. 124; IRA p. 41; Bisby p. 105.

Since Vittadini's name antedates Kuntze's by over sixty years, it clearly cannot be replaced by the latter if the two are synonymous. If they are not, there is even more clearly no case for conservation. It cannot be too often emphasized that conservation is authorized only "to avoid disadvantageous changes in the nomenclature of genera by the strict application of the Rules of Nomenclature." In this proposal and others like it, then, there must be some showing of a Rule whose "strict application" would produce "disadvantageous changes." None appearing, it is strongly recommended that the proposal be rejected.

It may be that here conservation is proposed as a ruse to settle authoritatively the question whether *Octaviania* and *Octavianina* are in fact synonyms. If so, that is not a legitimate purpose of conservation nor would the question be in any degree settled by conservation. In these notes it is given as an opinion (under *Melanogaster*) that the type of *Octaviania* is *O. asterosperma*. If that opinion be followed, the question of the synonymy of the genera is settled legitimately: *O. asterosperma* being presumably the type of both *Octaviania* and *Octavianina*, Vittadini's name stands without conservation, and supersedes both *Octavianina* and, presumably, *Arcangeliella* Cav.

OLPIDIOPSIS CORNU vs. PLEOCYSTIDIUM A. FISCH. and DIPLOPHYSA SCHROET. — IR p. 120; IRA p. 41; Bisby p. 101.

The bare proposal — all that seems to have been published on this case — seems completely pointless; *Olpidiopsis* antedates the two proposed nomina rejicienda by, respectively, twelve and seventeen years. Until it is made clear which rule it is whose "strict application" would invalidate *Olpidiopsis*, the motion is not in order. It should be rejected.

Although it is not so stated, the concern of this motion and the one to conserve *Pseudolpidium* (q.v.) seems to be with the intricacies and merits

of sensu and emendavit. In the main, it would seem preferable to leave the determination of the characters of a particular fungus to those who are working with the group to which it belongs. There is one correction which should, however, be made in the citation. *Olpidiopsis Saprolegniae*, which from Cornu's treatment is clearly the type of the genus, was explicitly published as a new combination for *Chytridium Saprolegniae* A. Braun, and must therefore be written "(A. Braun) Cornu." In transferring the epithet Cornu observed that Braun's fungus was not adequately characterized, but that "ce nom mérite cependant d'être conservé" (Ann. Sci. Nat. Bot. v **15**: 144. 1872); an "emendavit Cornu" may then be added to the citation. But if it could be shown that Cornu's fungus was different from Braun's, there could under the Rules (Art. 54 as amended at Amsterdam; see citations in the discussion under *Massaria*) be only one *O. Saprolegniae* — that represented by Braun's fungus; the *Pseudolpidium Saprolegniae* (A. Braun) and *Olpidiopsis Saprolegniae* (Cornu) offered by A. Fischer (in Rabenh. Krypt-Fl. 2 Aufl. **1 Bd. 4 Abt.:** 35, 38. 1892) are obligate synonyms.

OPHIOSTOMA H. & P. SYD., Ann. Mycol. **17**: 43. 1919 — Type: *Sphaeria pilifera* Fr., Syst. Mycol. **2**: 472. 1823 — vs. ENDOCONIDIOPHORA MÜNCH, Naturw. Zeits. Land. Forstw. **5**: 564. 1907 — Melin & Nannfeldt pp. 402–405.

Nannfeldt, l.c., states that the two names in question "will . . . become synonymous," and that "the name *Endoconidiophora* is the older and ought to be used for the enlarged genus." But since it "was intended explicitly for species with endogenously formed conidia, as the name implies," it would, he maintains, only cause misunderstanding to use it in the broader sense. He therefore proposes the conservation of *Ophiostoma*, which "is hardly used at all" and therefore would not be so confusing. However convenient it would be to select from a number of names the most apt, and to reject inept nomenclature, it is expressly forbidden under Art. 59; furthermore, it does not appear that conservation of *Ophiostoma* would accomplish the purposes set forth in Art. 21. It is therefore recommended that the proposal be rejected.

PANUS FR. vs. RHIPIDIUM WALLR. — IR p. 124; IRA p. 41; Donk 1941 p. 192; Singer & Smith 1946 pp. 255, 257.

PANUS FR. vs. PLEUROPUS GRAY — Singer & Smith 1946 pp. 250, 292.

Donk considers *Rhipidium* Wallr. a later homonym of *Ripidium*, earlier used by two authors, and the proposal for conservation therefore superfluous. Singer & Smith state that *Rhipidium* Wallr. is a synonym of *Schizophyllum* and therefore does not conflict with *Panus*. If *Rhipidium* Cornu be conserved, as recommended under that heading, Wallroth's name is even more surely discarded. It is recommended here also that the IR proposal be rejected.

In addition, however, Singer & Smith note that *Pleuropus* Gray (1821)

includes two species of *Panus* and a species of each of three other genera with which it would similarly conflict. They have chosen so to typify *Pleuropus* that it becomes an earlier synonym of *Panus* rather than of the other genera, and have proposed the conservation of *Panus* vs. *Pleuropus*. Their taxonomic decisions are here accepted, and their proposal seconded.

PAXILLUS FR. vs. RHYMOVIS PERS. and RUTHEA OPAT. — IR p. 124; IRA p. 41; Donk 1941 p. 192; Bisby p. 105; Singer & Smith 1946 pp. 257, 258, 293.

Donk correctly points out that *Paxillus* was published in 1835, thus antedating *Ruthea*, and that *Rhymovis* (which Persoon corrected, in the volume where it first appeared, to *Rhymoxis*) was not validly published in 1828, nor until after the appearance of *Paxillus*. He therefore states that the proposal is superfluous, and implies that it should be rejected. Singer & Smith agree to this, providing it is shown that *Paxillus* has priority. They did not take into account the Fl. Scan., which establishes this priority; to Donk's recommendation and theirs for the rejection of the proposal a third is here offered.

The correct citation for *Paxillus* is Fr., Fl. Scan. 339 (not 329). 1835.

PERISPORIUM FR. vs. ? — Ainsworth & Bisby 1943 p. 217; 1945 p. 232.

The proposal reads as follows: "Conservation necessary with *P. vulgare* Corda as type." Since there is no indication of the generic name which "by the strict application of the Rules" would displace *Perisporium* Fr., nor of the Rule under which Fries's name would be changed, this proposal is not in form for consideration. Fries described *Perisporium* in S.O.V. 161. 1825, and both the genus and sixteen species in Syst. Mycol. **3**(**1**): 248–253. 1829. There seems to be no earlier homonym. Since *P. vulgare* Corda is not one of the original species, if it later appears that *Perisporium* must be conserved another lectotype must be designated. It is recommended that the present proposal be rejected.

PERICONIA BON. vs. PERICONIA TODE EX FR. — Mason 1941 p. 123; Ainsworth & Bisby 1943 p. 216, 1945 p. 231.

After 1821 *Periconia* seems first to have been described by Link, Linn. Sp. Pl. ed. 5 (Willdenow) **6**(2): 109. 1825, for *P. byssoides* Pers., *P. subulata* Nees, and *P. nana* Ehrenb. Later in the same year Fries described the genus in Syst. Orb. Veg. 229, without description of species; he mentioned, l.c., "*Periconia Persicae, Robiniae.*" (For relative dates of Fries and Link, note that on pp. 361 and 365 of the S.O.V. Fries cites Link's work). In 1832 (Syst. Mycol. **3**(2): 307) Fries published a fuller description of the genus and a description of *P. Lichenoides*, Tode's original (pre-Friesian) species. The type of *Periconia* Link can then be *P. byssoides* or one of the other species listed; of *Periconia* Tode ex Fr., *P. Lichenoides*.

In 1851 Bonorden published descriptions of "*Periconia* Persoon" and of ten species (Handb. 112). The Persoon treatment in question is presumably that in Syn. Meth. Fung. 686, where *P. lichenoides*, *P. byssoides*,

and *P. stemonitis* are described. There is then no "*Periconia* Bon.", nor any reason to ascribe the genus to Bonorden, since if *P. lichenoides* is the type *Periconia* Pers. ex Bon. is the same as *Periconia* Tode ex Fr., and if either of the other species is the type it is the same as *Periconia* Link (Link having listed *P. stemonitis* as a synonym of his *P. subulata*).

Ainsworth & Bisby write "Conservation necessary, see Mason, 1941." Mason does not, l.c., propose conservation nor state that it is necessary. It is here submitted that *Periconia* Link is the correct designation for the genus; but under a different interpretation of the starting-point rule one would write *Periconia* Tode ex Fr. — and thereby change the type. In the absence of published arguments for the occasion or the desirability of conservation, it is recommended that the proposal be rejected. See *Periconia* among the later notes on nomina confusa.

PEZIZA FR. VS. ALEURIA FUCK. — IR p. 121; IRA p. 41; BMS 2 p. 281.

Since *Peziza* Fr. antedates Fuckel's name by forty-eight years, the proposal for conservation is unnecessary and should be rejected. Here as elsewhere, matters of choosing lectotypes can better be dealt with by experts than by a general committee, and should be left to the monographers.

PHALLUS PERS. VS. ITHYPHALLUS (FR.) FISCH. — IR p. 124; IRA p. 41; BMS 2 p. 284.

Since *Phallus* Pers., published at the very starting-point of nomenclature for the group to which it belongs, antedates *Ithyphallus* Fisch. by eighty-seven years, it is in no need of conservation. If *Ithyphallus* Fisch. were not invalidated by its late date of publication, it would still be rejected as a later homonym of *Ithyphallus* Gray, Nat. Arr. **1**: 675. 1821 (see notes under *Mutinus*). The proposal should be rejected.

PHELLINUS QUÉL. VS. PORIA PERS. EX KARST. — Donk 1941 pp. 158, 174, 176.

Since *Poria* Pers. ex Gray antedates *Poria* Pers. ex Karst. (see below under *Poria*) and has a different type, the use of the name *Poria* here proposed for rejection is automatically rejected on grounds of priority, and does not compete with *Phellinus*. The proposal is therefore unnecessary, and should be rejected.

PHLEOSPORA WALLR. VS. SEPTORIA FR. — IR p. 125; IRA p. 41; BMS 3 p. 291.

SEPTORIA SACC. VS. SEPTORIA FR. — BMS 3 p. 291.

The genus *Phloeospora* (not *Phleospora*) was published by Wallroth for two species — *P. Ulmi* (Fr.) and *P. Oxyacanthae* (Kuntze). Under the first species the author lists with the synonyms "Phloeospora Ulmi Wallr. in lit. 1815" and writes "a me ab anno 1810 inde observata itaque dicta." The second he treats more briefly, calls "rarior," and appears to have known from the descriptions or, perhaps, specimens of others. *P. Ulmi* is then clearly the species on which the genus was chiefly based; ergo, its

type. He gives "Septaria Kunz. Fr." as a synonym of the genus — that is, *Phloeospora* is a new name for *Septaria* of Kunze and of Fries.

Septaria was described by Fries in Novit. Fl. Suec. (Part V) 78. 1819; the type was designated as *S. Ulmi*. The first publication of the name after 1821 appears to be *Septaria* Fr. ex Kunze, Mykol. Hefte **2**: 107. 1823; there *S. Ulmi* Fr. is described at length and a shorter treatment is given of *S. Oxyacanthae* Kunze. In S.O.V. 119, 195. 1825 Fries himself again described the genus, changing the name to *Septoria* ("Olim *Septariam* dixi, quod nomen ob animal homonymon paululum mutavi."); no species are there listed. In Elench. **2**: 117. 1828 Fries gave an extended discussion of *Septoria*, listing, in addition to his own *S. Ulmi*, *S. Oxyacanthae* Kunze and *S. Fraxini* (DC.). In Syst. Mycol. **3**: 480. 1832 he published a further note on *Septoria*, observing that Desmazières had added some species. These additional species Fries neither described nor accepted, nor did he even indicate that he was acquainted with their characters. Whether the spelling of the genus is *Septaria* or *Septoria* depends on one's interpretation of the starting-point rule, Art. 20 (f); there can be no doubt that the type of the genus, whether *Septaria* Fr. ex Kunze or *Septoria* Fr., is *S. Ulmi* and that *Phloeospora* Wallr. is an obligate synonym. Finally, in Summ. Veg. Scand. 426. 1849 Fries wrote "Species typicae, v.c. *S. Ulmi*, *Oxyacanthae* . . ."

The second proposal is to conserve *Septoria* Sacc., Syll. Fung. **3**: 474. 1884 against *Septoria* Fr. 1828. There is no *Septoria* Sacc.; what Saccardo treats, l.c., is "*Septoria* Fr. S.M. III. p. 480, emend. Sacc. Mich. II. p. 6." In Michelia, l.c., Saccardo includes *S. Ulmi*, Fries's type, making it doubly certain that there is no genus *Septoria* Sacc. "definitely accepted by the [alleged] author" (Art. 37 as amended at Amsterdam; cf. Zesde Int. Bot. Congr. Proc. **1:** 365; IRB p. 76; IRA p. 13).

The conservation of a non-existent name being impossible (see discussion under *Acrothecium*), the second proposal should be rejected. If the use of *Septoria* in its correct sense should produce confusion because of later misuse of the name, it can be rejected as a nomen ambiguum. There is no obstacle to the adoption of the first proposal (except that *Phloeospora* Wallr. is misspelled in IR); if it be found desirable to retain Wallroth's name, that may well be done. From lack of knowledge of the nomenclatorial consequences, no recommendation is offered here.

PHLYCTIDIUM (BRAUN) RABENH. VS. PHLYCTIDIUM WALLR. — Sparrow p. 147; Ainsworth & Bisby 1945 p. 239.

Because of the existence of Wallroth's earlier homonym, which appears no longer to have any currency, it is proposed to conserve *Phlyctidium* (Braun) Rabenh. For this genus there is already a valid name, *Tylochytrium* Karling, Mycologia **31**: 287. 1939. *Phlyctidium* was first published by Braun, as a name for a subgenus of *Chytridium*, to include the largest part of the genus (16 species out of 22); the lectotype of the subgenus and of the genus based on it must come from among these 16 original

species. Sparrow includes all 16, as synonyms or as accepted or doubtful species, in other genera, leaving the name *Phlyctidium* for a group of fungi ostensibly not congeneric with any of the original species. It is submitted that for this group some other name ought to be used, as prescribed in Art. 18 (or, since Sparrow considers it of doubtful distinctness, that it ought to be abandoned), and that *Phlyctidium* (Braun) Rabenh. may well be relegated to oblivion under the operation of Art. 61. It is recommended that the proposal be rejected.

It would be possible, under Art. 47 (see discussion under *Phoma*), to maintain that there is a genus *Phlyctidium* Sparrow 1943, and to propose its conservation. But it appears obvious that no author would wish to (1) exclude all the original species from a genus, (2) claim authorship of the genus on the grounds that he thereby excluded the type, and in the same work (3) propose for conservation the genus thus erected; and that in the case in question the "exclusion of the type" was inadvertent.

PHOMA DESM. NON FR. VS. SPHAEROPSIS LÉV. — IR p. 125; IRA p. 41; BMS 2 pp. 288, 289.

PHOMA DESM. VS. PHOMA FR. — BMS 2 p. 289.

On the showing of the B.M.S. committee *Sphaeropsis* Lév. (q.v.) is monotypic, and its type is not congeneric with *Phoma* in any sense. As a consequence, the two names do not conflict, and the IR proposal is out of order. *Sphaeropsis* Lév. "emend. O. Kuntze" has of course no standing whatever. The proposal should be rejected.

Phoma Fr., Syst. Mycol. **2**: 546. 1823, was published for five species. Of these *P. Filum* was excluded two years later by Fries himself (Syst. Orb. Veg. 120); thereby the number of species eligible as lectotype was reduced to four: *P. saligna*, *P. Populi*, *P. pustula*, and *P. tularostoma*. Of these *P. tularostoma* should be excluded from consideration on the ground that Fries had never seen it, whereas he studied living material of *P. saligna* and *P. pustula* and dried material of *P. Populi*. Although *Phoma* Fr. as described in Novit. Fl. Suec. 80. 1819 is pre-Systema and invalid, it is certain that any indication there given of the species Fries had chiefly in mind in describing the genus is a cogent one; and there Fries listed only one: "Typus: *Sph. pustula* P." It is submitted that *Sphaeria pustula* Pers. is therefore not only an acceptable lectotype but the immutable type of *Phoma* Fr.

It is proposed in BMS to conserve against *Phoma* Fr. the genus *Phoma* Desm. 1849. In Ann. Sci. Nat. Bot. iii. **11**: 278. 1849 (which is the 16th Notice, not 13th, as given in IR) Desmazières gives a long description and a longer discussion of "*Phoma* Fr., Corda, Mntg., etc. emend.", and descriptions of ten species. So much would, of course, forbid the attribution of *Phoma* to any author besides Fries.

To the straightforward and uncomplicated taxonomic intelligence this would appear to be another case of the mere addition to a genus of alien species. Unfortunately, the Rules do not seem to have been composed for

or by such an intelligence. It is pertinent here to note an accretion (italicized) to Art. 47 adopted at Amsterdam: "An alteration of the diagnostic characters or of the circumscription of a group *without exclusion of the type* does not warrant the citation of an author other than the one who first published its name" (Zesde Int. Bot. Congr. Amsterdam Proc. **1:** 344; IRB p. 81; IRA p. 16). This phrase "without exclusion of the type" appears to imply an impossibility: since "a nomenclatorial type is that constituent element of a group to which the name of the group is permanently attached" (Art. 18), it would seem that exclusion was excluded by the definition of "type."

To the authors of the Rules nothing, apparently, has seemed impossible; and in consequence those who follow them are compelled to remain on the alert, to discover whether there exists a case of "exclusion of the type," and to stigmatize it in the manner implied by Art. 47. It is submitted that if such a case exists it is here. For on p. 279 Desmazières writes, "Le *Phoma pustulata*, Fr., est un *Sphaeria*." Since Fries had not published a *P. pustulata*, it seems clear that the reference is to *P. pustula*. Thereby Desmazières explicitly excluded the type from the genus *Phoma*; and in consequence it could be considered permissible under the amended Art. 47 to cite Desmazières as author of a genus *Phoma*. If that were done it would not, however, be permissible to designate *P. herbarum* Westend. as the lectotype of Desmazières's genus, since *P. herbarum* is not among the species included, l.c. The choice of a type, from among the ten species described by Desmazières, should be made by one acquainted with the species involved.

So much for Art. 47 and its bearing on the case in question. As already noted, the principles of the type method, insofar as they are included in the Rules, are set forth in Art. 18. It is submitted that where a subsidiary provision, like the phrase "without exclusion of the type" appears to conflict with Art. 18 the latter must be authoritative. Now whereas Art. 47 may be thought to imply that exclusion of the type warrants the citation of an author other than the one who first published the name, Art. 18 states unequivocally that "The name of a group must be changed if the type of that name is excluded." That statement is the essence of the type method, and is accepted as such, both by those who follow and those who reject it; if that statement were deleted, or its provisions relaxed, the type method would thereby be eliminated from the Rules. Whatever permission seems to be granted by Art. 47 for changing the *author*-citation, no evasion is permitted by Art. 18 of the obligation to change the name; and whereas the former may allow one to write "*Phoma* Desm. non Fr.", the latter requires that even though the group *Phoma* Desm. is recognized as an autonomous genus (and legitimately typified) it be called by another name.

It is here admitted that the application of Art. 18 can in such a case as this be avoided by conservation; because of the equivocal nature of Art. 47 and the great importance of the preservation of Art. 18 it is recommended

that no conservation be here attempted. See notes under *Sphaeropsis* and *Hypospila*. A motion is being published (Mycologia **41:** 215–219. 1949) to delete the phrase "without exclusion of the type."

PILACRE (FR.) WEINM. VS. PHLEOGENA LK. — IR pp. 123, 127; IRA p. 41; Donk 1941 p. 193.

The "*Phlogiotis*" printed as an alternative name to *Pilacre* probably was dropped a line (in IR) from the preceding proposal. It has nothing to do with *Pilacre*.

What the authors of the proposal under discussion meant by "(Fr.) Weinm." is not clear; they would seem to imply that *Pilacre* was published in some infrageneric rank by Fries and elevated to generic rank by Weinmann. As a matter of fact, *Pilacre* was originally published as a genus, by Fries, in S.O.V.; its type is a Weinmann fungus, "Stilbum incarnatum *Weinm. in litt.*" (*Pilacre Weinmanni* Fr., Syst. Mycol. **3**: 204. 1829). Neither Fries nor Weinmann ever included in it the name of the proposed lectotype, *P. Faginea*. For a good many years there has been discussion concerning the identity of *P. Weinmanni*. Earlier discussions are summarized by Costantin (Jour. de Bot. **2:** 299. 1888) and Boudier (Jour. de Bot. **2**: 261. 1888); these authors are agreed that it is an ascomycete; Boudier states that it is the same as *Roesleria*. Juel, Shear & Dodge (Jour. Agr. Res. **30:** 413. 1925), and Donk think it more probable that the species is a lichen. One thing is certain from Fries's generic description and Weinmann's manuscript name: *P. Weinmanni* has no more relation to *Phleogena*, the basidiomycete, than has *Phlogiotis*. Donk, Martin (Univ. Iowa Studies N. H. **18**(3): 69. 1944), and other mycologists use the valid name *Phleogena*; although they do not use that name, Shear & Dodge (l.c. p. 414) state that *Phleogena* is "the oldest valid name." The proposal should be rejected.

PLEUROTUS (FR.) QUÉL. VS. PTEROPHYLLUS LÉV. — Donk 1941 pp. 158, 175; Singer & Smith 1946 p. 260.

PLEUROTUS (FR.) QUÉL. VS. CREPIDOPUS (PERS.) EX GRAY — Singer & Smith 1946 pp. 250, 260, 294.

Both proposals seem to be in order; and since *Pleurotus* is used for a common and relatively important genus, it is recommended that both be adopted.

The authors of the second proposal cite *Crepidopus* twice as "(Pers.) ex Gray" and once (p. 266) as "Nees v. Esenb. ex Gray." Gray attributes the name to "Esenbeck" (the reference would presumably be Syst. Pilze Schwamme 195. 1817), and "Nees ex Gray" would seem the preferable form.

Pleurotus (Fr.) Quél. was published in Soc. Émul. Montbéliard Mém. ii **5**: 62 (and should be so cited) and in Ch. Jura Vosges 23. Quélet used the spellings *Pleurote* and *Pleuropus* on, respectively, pp. 111 and 325 of the first and pp. 77 and 313 of the second of the cited works. See note

under *Flammula*. It seems unlikely that the name *Pleuropus* as used by Quélet was anything but an unintentional misspelling, or that it has anything to do with *Pleuropus* Gray (see notes under *Panus*).

PLOWRIGHTIA SACC. VS. DOTHIDELLA SPEG. — IR pp. 122, 127; IRA p. 42; BMS 3 p. 286.

According to the evidence presented in BMS, the type of *Dothidella* is *D. australis* Speg. and the genus is not synonymous with *Plowrightia*. Their recommendation to reject the proposal is here seconded.

PODOSCYPHA PAT. VS. CRATERELLA KARST. — IR p. 123; IRA p. 42; Donk 1941 p. 194.

Since *Craterella* Karst. 1882 is a later homonym of *Craterella* Pers. ex Gray, Nat. Arr. **1**: 652. 1821, it is rejected without special action. The type of Gray's genus is *C. caryophyllea*, a member of *Thelephora* or *Phylacteria* (according to the classification employed), and not congeneric with the members of *Podoscypha* Pat. Since conservation is therefore not needed to preserve Patouillard's name, the proposal should be rejected.

PORIA (FR.) KARST. EMEND. SACC. VS. PHYSISPORUS GILL. — IR p. 123; IRA p. 42; BMS 1 p. 226; Cooke p. 85; Ainsworth & Bisby 1943 p. 243; 1945 p. 260; Bisby p. 104.

PORIA PERS. EX CKE. VS. PHYSISPORUS CHEV. and PORIA PERS. EX KARST. — Donk 1941 pp. 158, 174, 176.

Since *Poria* Pers. ex Gray was published (Nat. Arr. **1**: 639) in 1821, it antedates the proposed nomina rejicienda and stands without conservation; and it is *Poria* in the currently accepted sense. The proposals are therefore unnecessary (as noted by Ainsworth & Bisby) and should be rejected. See notes under *Phellinus*.

PORODISCULUS MURR. VS. ENSLINIA FR. — IR p. 123; IRA p. 42; Donk 1941 p. 195.

It is stated by Donk, as in IR, that *Enslinia* Fr. is a later homonym of *Enslinia* Reichenb. The entry in Reichenbach's Conspectus carries no description, consisting merely of the following: "3428. Enslinia Nutt." It seems unnecessary to insist upon the necessity in earlier works of all the machinery of citation expected of more recent authors, and the "Nutt." may be accepted as the "reference" required for effective publication under Art. 37. Even if that be not granted, *Enslinia* Fr. appears, under Art. 70, note 3, and "Examples of orthographic variants," to be a homonym of *Enslenia* Nutt. In either case, *Enslinia* Fr. is already rejected, and does not compete with *Porodisculus*. Donk's recommendation that the proposal be rejected is here seconded.

Enslinia Fr. was published in Fl. Scan. 347. 1835.

PSATHYRA (FR.) QUÉL. VS. PSATHYRA COMMERS. EX SPRENG. — Ainsworth & Bisby 1943 p. 246, 1945 p. 263; Singer & Smith 1946 p. 265.

The conservation of *Psathyra* as a generic name for agarics is desirable; from meager information at hand it seems unlikely that the earlier homonym *Psathura* Commers. ex Jussieu, Gen. Pl. 206. 1789 (and its variant spelling *Psathyra* Commers. ex Spreng., Anleit. Kenntn. Gew. 2 ed **2**(2): 614. 1818) of the Rubiaceae will be relinquished by taxonomists of vascular plants. The possibility of agreement should be investigated in consultation with the appropriate special committee. If it proves possible to conserve *Psathyra*, some other type than *P. spadiceo-grisea*, the species nominated by Singer & Smith, must be chosen; that species was not included in *Agaricus* Trib. *Psathyra* Fr., Syst. Mycol. **1**: 295.

Psathyra (Fr.) Quél. was published in Soc. Émul. Montbéliard Mém. ii **5**: 148 (and should be so cited) and in Ch. Jura Vosges 118. See notes under *Flammula*.

PSEUDOGRAPHIS NYL. VS. KREMPELHUBERIA MASSAL. — IR p. 122; IRA p. 42; BMS 3 p. 287.

On the showing of the B.M.S. committee there is no obstacle to the conservation of *Pseudographis*. If the name be considered of sufficient importance, it may well be conserved.

PSEUDOLPIDIUM A. FISCH. VS. OLPIDIOPSIS CORNU — IR p. 120; IRA p. 42; Bisby p. 101.

This motion is correlated with that earlier discussed, to conserve *Olpidiopsis* (q.v.) against two later genera. The proposals make a curious pair — the one, to conserve *Olpidiopsis* Cornu emend. A. Fisch. 1892, and the other to reject *Olpidiopsis* Cornu emend. A. Fisch. 1880. Since the incorporation of the type concept into the rules, such a pair of proposals is out of order: there is only one *Olpidiopsis* Cornu (which can be retained or rejected, but not both simultaneously), the *Olpidiopsis* which retains the type of the genus, in this case clearly *O. Saprolegniae* (A. Braun) Cornu. Here again the proposal is extraordinary — to typify the retained *Olpidiopsis* by *O. Saprolegniae* Cornu em. A. Fisch. pp. 34, 38, and the retained *Pseudolpidium* by *P. Saprolegniae* A. Fisch. p. 35. As noted in the discussion of *Olpidiopsis*, these are obligate synonyms: *Pseudolpidium Saprolegniae* (A. Braun) Fisch. ≡ *Chytridium Saprolegniae* A. Braun ≡ *Olpidiopsis Saprolegniae* (A. Braun) Cornu. Because of this synonymy it is greatly preferable to designate *Pseudolpidium fusiforme* (Cornu) A. Fisch., which according to Fischer likewise shows the generic character, as the type of the genus.

In any case, the proposal to conserve *Pseudolpidium* against Fischer's 1880 idea of *Olipidiopsis* is wholly unnecessary; Fischer's 1880 idea has no standing unless it refers to Cornu's genus, and that Fischer himself denied in 1892. One need not conserve a validly published name against

an earlier misapplication. Finally, if McLarty (Torrey Bot. Cl. Bul. **68**: 48 et seq. 1941) is correct, the two generic names apply to but one genus in any case. The proposal should be rejected.

PUCCINIA PERS. vs. PUCCINIA (MICH.) ADANS. and PUCCINIA WILLD. — IR pp. 126, 127; IRA p. 42.

The proposals seem to have been written with a singular disregard of the Rules. The Persoon genus is cited as "*Puccinia* Pers. Neues Mag. Bot. Römer I. (1794) 118." Since the starting-point for nomenclature of the rusts is Persoon's Synopsis, 1801, "*Puccinia* Pers. . . . . 1794" is non-existent. On the other hand, *Puccinia* Pers., Syn. Meth. Fung. 225. 1801 — the *Puccinia* with which mycologists are concerned — stands without conservation against all synonyms. The Adanson and Willdenow names proposed as nomina rejicienda were published in, respectively, 1763 and 1787, and are therefore rejected by the normal operation of the Rules.

It is possible that these proposals, and others as incomprehensible, were advanced as *proposita eventualia*, to be considered if the adoption of Rules different from those now in operation should invalidate genera now valid. Until the achievement of that eventuality, the proposal should be rejected.

RAMARIA (FR.) BON. vs. CLADARIA RITGEN — Donk 1941 pp. 158, 177; Doty p. 128.

Ramaria Holmsk. ex Gray, Nat. Arr. **1**: 655, antedates *Cladaria* 1831 and is valid without conservation. *Ramaria* (Fr.) Bon., a concept of uncertain application, has never had any currency and consequently its conservation could not be said to "avoid disadvantageous changes in the nomenclature of genera" (Art. 21). The proposal should be rejected.

RAMULARIA FRES. vs. CYLINDROSPORA SCHROET. — IR p. 125; IRA p. 42; BMS 3 p. 292.

RAMULARIA SACC. vs. RAMULARIA UNGER EX CORDA — BMS 3 p. 292.

In BMS it is pointed out that most of the data on authors and places of publication in the IR proposal are wrong; these corrections need not be repeated here. As there amended, the proposal should read: "*Ramularia* Unger ex Corda — Type: *R. pusilla* — vs. *Cylindrospora* Grev. ut '*Cylindrosporium*' ex Unger." Since there has been no expression of desire or need for the adoption of such a proposal, it is recommended that the first proposal here cited be rejected. The B.M.S. committee has also stated, "Schroeter . . . adopted '*Cylindrospora* Grev.' to replace *Ramularia* in the sense of Saccardo. As this excluded Greville's type species, Schroeter's use is now invalid." It is submitted that Saccardo's use of "*Ramularia* Ung." is equally invalid; and since Saccardo never published a genus *Ramularia* Sacc. (see notes under *Acrothecium*), there is no such genus; the second proposal must also be rejected.

RHABDOSPORA DUR. & MONT. vs. FILASPORA PREUSS — IR p. 125; IRA p. 42.

Rhabdospora as used by Durieu & Montagne was a section of *Septoria* — and a nomen nudum. It seems first to have been published by Saccardo, Michelia **2**: 6. 1880, as an infrageneric group (rank not specified) within *Septoria*; Saccardo gave a description and an example, "*S. pleosporioides* Sacc." It seems to have been employed for the first time as a generic name, again by Saccardo, in Syll. Fung. **3**: 578. 1884. It would be permissible to cite the genus as *Rhabdospora* (Sacc.) Sacc. 1884; since in both places Saccardo attributed it to "Mont.", it would better express his intention to write "(Dur. & Mont. ex Sacc.) Sacc.", indicating that Saccardo had adopted an earlier name applied to a group of fungi not described but whose members were known. In that event the two species most eligible as type are *R. Oleandri* (Dur. & Mont.) and *R. peregrina* (Dur. & Mont.), which were included both in the earlier undescribed section and in Saccardo's genus. If the genus be attributed to Saccardo alone, there are eighty-six possible choices, of which *R. ramealis*, listed in IR, seems to have no better claim than many others.

In either case, Saccardo's nomenclatorial procedure is hard to justify; for he adopted an undescribed infrageneric name in place of Preuss's adequately described genus *Filaspora*, retaining three of Preuss's four species (against two out of a dozen of Durieu & Montagne's) and reducing them to synonymy under names which he himself published; Saccardo even substituted his own specific epithet "*Preussii*" for one of Preuss's. There seem, however, to be no obstacles to conservation of Saccardo's name if that seems desirable to students of such fungi.

RHIPIDIUM CORNU vs. RHIPIDIUM AUCT. — Lütjeharms; Donk 1941 p. 192.

The exact definition of "orthographic variant" being as yet not established, it is not certain that all the nomina rejicienda proposed are actually homonyms. But *Rhipidium* Wallr. (for which see notes under *Panus*, and Singer & Smith p. 255) undoubtedly is, and since conservation of *Rhipidium* Cornu automatically rejects all names subsequently judged to be homonyms, the proposal "*Rhipidium* Cornu vs. *Rhipidium* Wallr." will suffice. The genus is perhaps of sufficient size and interest to make conservation appropriate, the more so that it appears to have but the one name. It is recommended that the proposal be adopted.

RHODOPHYLLUS QUÉL. vs. ACURTIS FR., ENTOLOMA (FR.) QUÉL., LEPTONIA (FR.) QUÉL., NOLANEA (FR.) QUÉL., ECCILIA (FR.) QUÉL., and CLAUDOPUS (FR.) GILL. — Singer p. 50; Singer & Smith 1946 pp. 261, 278, 295, 1948 p. 629.

Rhodophyllus is one of the most extravagantly superfluous names yet published for fungi, perhaps exceeding in that respect even *Sordaria*. Like that name (q.v.), it is several times over an illegitimate name under Art. 60 (1). In erecting *Rhodophyllus* in 1886 Quélet divided its species among

five sections or subgenera, four being Friesian groups which he himself had elevated to the rank of genera in 1872, and the fifth, one so elevated in 1876. Since all of the proposed nomina rejicienda except *Acurtis* are better established, and more familiar to the majority of mycologists, than *Rhodophyllus*, it appears doubtful that the proposal would produce "fixity of names" (Art. 4) or "avoid disadvantageous changes" (Art. 21). *Rhodophyllus* is one of two generic names proposed by the authors for "conditional conservation"; the legitimacy of such conservation is argued on an earlier page of these notes under *Marasmius*, and the discussion need not be repeated here. The present proposal is fundamentally different. There *Marasmius* may be (and is, by the author of the proposal) considered generically distinct from the alternative genus, and the conserved name displaces the other only when the two are held to be taxonomic synonyms. Here *Rhodophyllus* is composed exclusively of five infrageneric groups synonymous and cotypic with five Friesian groups already raised to the rank of genera; *Rhodophyllus* must then be nomenclatorially synonymous with one of those genera. By the authors of the proposal it is in fact made synonymous with *Entoloma* (1946 p. 278). If the conservation were approved, *Rhodophyllus* would displace the other nomina rejicienda only when they were held to be taxonomic synonyms of the conserved name; but being an absolute synonym of *Entoloma* (same type) *Rhodophyllus* would in all cases displace that name. This is not what is wanted, either by the authors of the proposal or by anyone else. One vote is here cast against the proposal; it is highly desirable that other mycologists, especially those who, like Singer and Smith, are students of the agarics, should consider it further.

Acurtis Fr. is the only one of the proposed nomina rejicienda that is not in current use. The authors question whether it can be rejected under Art. 65 as "based on a monstrosity." It appears that the abortive carpophores of *Clitopilus abortivus* on which apparently the name *Acurtis* was founded do not bear basidia; if that be the case, *Acurtis* must be rejected under Art. 57 as based on an imperfect state (cf. Rogers 1948). What seems to be a part of the type collection of *Clavaria gigantea* Schw., Naturf. Ges. Leipzig Schr. **1**: 113. 1822, the genotype of *ACurtis* [!] Fr., Summ. Veg. Scand. 337. 1849, now in the Farlow Herbarium, has no basidia nor basidiospores; and unless contrary evidence appears, that may be taken to settle the case of *Acurtis*.

Entoloma (Fr.) Quél. was published in Soc. Émul. Montbéliard Mém. ii **5:** 116 and in Champ. Jura Vosges 83 (see note under *Flammula*); *Leptonia* on pp. 121 and 88 of the respective works; *Nolanea* on pp. 122 and 89; *Eccilia* on pp. 123 and 90.

SCOLECOTRICHUM KUNZE & SCHMIDT EX FR. vs. ——? — Ainsworth & Bisby 1943 p. 269, 1945 p. 287.

Von Höhnel (Centralbl. Bakt. 2 Abt. **60**: 6. 1923) states that the type of *Scolectotrichum* Kunze, Myc. Hefte **1**: 10. 1817 (*S. virescens* Kunze)

is doubtfully a fungus and has never been recognized; Saccardo (Syll. Fung. **4**: 35) states in quotes that it is a "dubia species." *Scolectrichum* Kunze & Schmidt ex Link, Linn. Sp. Pl. ed. 5 (Willd.) **6** (**1**): 35. 1824 and *Scolecotrichum* Kunze ex Fr., Syst. Mycol. **3**: 449. 1832, still contain but the single species. Link saw dried material, but his discussion adds nothing to the original descriptions; Fries had only the descriptions and figures. There can be no question that the type is *S. virescens*, nor any evasion of the conclusion that both that binomial and *Scolecotrichum* are nomina dubia, rejected under Art. 63. It is recommended that the proposal be rejected.

SCOPULARIA PREUSS, Linnaea **24**: 133. 1851 — Type: *S. venusta* Preuss, l.c. p. 134 — and SCOPULARIA LINDL., Edwards Bot. Reg. **20**: pl. 1701. 1834.

According to Goidanich (Ann. Mycol. **31:** 134–138. 1933) *Scopularia* Preuss includes three species, of which the type species is unknown except for the original descriptions; it has (he states) as a later synonym *Leptographium* Lagerb. & Melin. If that synonymy be rejected, Preuss's genus is reduced to one known species, *S. scopula* Goid. No proposal for conservation has been published, and none is offered here; the only intent is to note the earlier homonym. Lindley's name is listed among the rejicienda in Kew Bul. Mis. Inf. **1940**: 96, where it is cited as published "in Edw. Bot. Reg. XX (1834) sub t. 1701." It is there, however, a nomen nudum and probably a nomen eventuale; but Lindley later published it in Gen. Sp. Orchid. Pl. 303. 1835.

SECOTIUM G. KUNZE VS. ENDOPTYCHUM CZERN. — Ainsworth & Bisby 1943 pp. 101, 270.

The authors cited write (p. 270) "Conservation against *Endoptychum* may be necessary." In the second edition of their *Dictionary* mention of conservation is dropped. There are two reasons, either sufficient, why conservation should not be attempted: (1) *Secotium* antedates *Endoptychum*, by five years; and (2) the two names are coming to be considered to apply to different genera (cf. Kambly & Lee, Univ. Iowa Studies N.H. **17**: 126. 1936; confirmed by Dr. S. M. Zeller in litt.). The proposal, if it is one, should be rejected.

SEPTOBASIDIUM PAT. VS. GLENOSPORA BERK. & DESM. and GAUSAPIA FR. — Boedijn & Steinmann p. 171; Couch pp. 67–68; Donk 1941 pp. 158, 178.

Septobasidium is a name universally employed for a large and well-known genus; *Gausapia* has always been obscure; and *Glenospora*, besides being little known as a name for the fungi to which it is applicable, has by the eager ineptitude of non-mycologists been given considerable currency as a name for a pathogen on human beings. There is every reason then for adopting the present proposal.

Donk has proposed (l.c.) that *Thelephora pedicellata* Schw. sensu Pat.

(*S. Couchi* Donk) be accepted as the type. In this he has overlooked the fact that, as Martin (1944 p. 71) has pointed out, Patouillard effectively designated his own type. *Septobasidium* was established for two species: *S. pedicellatum* (Schw.) Pat. and *S. velutinum* Pat. Later in the same year, in a further discussion, Patouillard divided his genus into two groups: *Typicae*, with *S. velutinum*, and *Podobasidium*, with *S. pedicellatum*. The motion for conservation should therefore read *Septobasidium* Pat. . . . .— Type: *S. velutinum* Pat. — vs. *Gausapia* Fr. . . . and *Glenospora* Berk. & Desm. . . . In such a form it is recommended for adoption.

SEPTORIA SACC. VS. SEPTORIA FR. — see *Phleospora*, on an earlier page.

SORDARIA CES. & NOT. VS. SCHIZOTHECIUM CORDA, PLEURAGE FR., and PODOSPORA CES. — IR pp. 122, 127; IRA p. 42; Cain pp. 5–10; Cain & Groves pp. 486–487.

If ever a name was published which should not have been, *Sordaria* is such a name. *Schizothecium* Corda, Icon. Fung. **2:** 29. 1838, was monotypic on publication; its type species is listed as a possible synonym of *Sordaria fimiseda* by Cesati & De Notaris. (In Bot. Zeit. **14**: 429, and in the place of publication of *Podospora*, it is stated that *Schizothecium* "observed in old specimens [was] hence imperfectly founded"; but a genus is not invalidated on such grounds. Fries, Summ. Veg. Scand. 418, alleges the existence of two earlier homonyms. But the first is not strictly a homonym, and the second was before 1841 a nomen nudum). *Enterobotryum* Preuss, Linnaea **25**: 733. 1852 is monotypic; Cesati & De Notaris list it as a synonym of *Sordaria*, and its type as *S. conicum* (Preuss). *Podospora* Ces. ex Rabenh., Klotzsch Herb. Viv. Mycol. ed. nova. Cent. **3**: 258. 1856; Bot. Zeit. **14**: 429. 1856, was likewise monotypic: it was based on *P. fimicola* (Corda) Ces. and is an obligate synonym of *Schizothecium*. Cesati & De Notaris list it as a synonym of their *Sordaria fimiseda*. *Malinvernia* Rabenh., Hedw. **1**: 116. pl. 15, fig. 4, 1857 was likewise monotypic; the name was given to *Sphaeria anserina* Ces. in litt. At first glance it would appear to be a nomen nudum; but it is undoubtedly "validated" (Art. 43) by "a plate with analyses." Cesati & De Notaris do not list the species in their original publication of *Sordaria*, but do cite *Malinvernia* as a synonym of their genus. *Pleurage*, sometimes used for *Sordaria*, is cited as having been published by Fries in Summ. Veg. Scand. 418. 1849. There, however, it is a nomen provisorium, "proposed . . . in anticipation of the eventual acceptance of the group . . . [and] not validly published" (Art. 37; Zesde Int. Bot. Congr. Amsterdam Proc. **1**: 365. 1936; IRB p. 76; IRA pp. 13, 14). For Fries used it only in the following manner: "*Schizothecium. Cord.* . . . Genus mihi ignotum . . . . Si genus recipiatur, nomen mutandum . . . et aptius dicatur *Pleurage*." *Pleurage* seems not to have been used again until it was taken up by Otto Kunze; it is of course an obligate synonym of *Schizothecium* and *Podospora*. It is not an obligate synonym of *Sordaria* unless to the latter genus is assigned *S. fimiseda* Ces. & Not. as a lectotype; Griffiths (Torr. Bot. Cl. Mem. **11**: 55. 1901)

and other authors treated *Pleurage* as distinct. Having the names *Schizothecium*, *Enterobotryum*, *Podospora*, *Malinvernia*, and perhaps even *Pleurage* to choose from, the third a Cesati name and the fourth based on Cesati material, Cesati & De Notaris elected to publish still another name, *Sordaria* (Soc. Crittog. Ital. Comm. **1**: 255. 1863) for the group. Their name is superfluous several times over — that is, "the group to which it was applied, as circumscribed by its author[s], included the type[s] of [several] name[s] which the author[s] ought to have adopted" (Art. 60 (1); Zesde Int. Bot. Congr. Amsterdam Proc. **1**: 354 (Art. B60). 1936; IRB p. 90; IRA p. 22).

Since *Sordaria* has been proposed for conservation, the question of its type is important. Of the twelve species enumerated by Cesati & De Notaris some are clearly less eligible than others. Some of the species were certainly seen by the authors; two, *S. conica* and *S. fimicola*, were merely accepted from published descriptions, and should undoubtedly not be considered. Griffiths (Torr. Bot. Cl. Mem. **11**: 40) writes that *S. fimicola* (Rob.) "remains to represent our present concept of the genus," all others having been transferred elsewhere or dropped, and thereby implies that it should be the lectotype; and Cain (p. 9) singles out the same species; but as already noted, that is one of the two species that the authors of the genus knew only "ex Diagnosi," against ten they had examined. Griffiths & Seaver (N. Am. Fl. **3**: 65. 1910) later made the same species the type of the genus *Fimetaria*. Of the species eligible as lectotype a good case can be made for the selection of *Sphaeria sordaria* Fr., the evident source of the generic name, or for *S. fimeti*, *S. coprophila*, *S. fimiseda* (cf. Cain & Groves), and *S. pauciseta*, all of which are listed as having been illustrated by Cesati. Within that list of five should be found the entity which the authors had chiefly in mind in describing the genus.

No further recommendation is here offered; the final selection of the type, and the decision whether conservation is desirable, should be left to students of the group.

SPEGAZZINULA SACC. VS. DUBITATIO SPEG. — IR p. 121; IRA p. 42; BMS 3 p. 282.

This is one more case where, Saccardo having chosen to be a law unto himself, it is proposed by conservation to make him a law unto all generations. The law on the point is contained in Art. 59; and even if there were no such rule, it would be hard to defend *Spegazzinula*, on grounds either of euphony or expressiveness, against *Dubitatio*. Botany has become impoverished indeed if the "serious motives" (Art. 17) supposed to underlie the naming of plants leave no room for a jest. The B.M.S. committee finds two binomials in Saccardo's genus and one in Spegazzini's. Their recommendation for rejection of the proposal is here seconded.

SPHAERELLA CES. & NOT. 1863 vs. MYCOSPHAERELLA JOHANS. 1884 — IR p. 122; IRA p. 42; BMS 1 p. 220; Bisby p. 102.

The British proposal differs from that published in the Rules chiefly in listing the name to be conserved as "*Sphaerella* (Fr.) Rabenh. (1856)," Herb. viv. mycol. ed. 2, no. 264. The printed Rabenhorst label cited reads as follows: "264. *Sphaerella punctiformis* (Pers.) Rabenh. Mspt. var. *perexigua* Desm. In Quercus foliis passim." By the British committee "it is submitted that this transfer raised the subgenus *Sphaerella* Fr. to generic rank." It is here submitted, on the contrary, that so far as the Rabenhorst label is concerned the subgenus *Sphaerella* Fr. is not involved in any way (it is not cited even obliquely), and the generic name *Sphaerella* and specific name *Sphaerella punctiformis* are there nomina nuda. Alternatively, one must ask under what Article — 37, 42, 43, or 44 — they were validly published.

As noted in the British proposal, *Sphaerella* Ces. & Not. as published in 1863 is quite independent of Fries's subgenus; as a matter of fact it does not include (at least, not by name) any species listed by Fries. Neither does it include *S. Asteroma* (Fr.) Karst., proposed in IR as the type. There are twenty-five species eligible as the lectotype of *Sphaerella* Ces. & Not.; but *S. Asteroma* is not one of them. Nor is that species a possible lectotype for *Sphaeria* subg. *Sphaerella* Fr. 1849 or *Sphaerella* (Fr.) Fuckel, Symb. Mycol. 99 [1870] (not 1869!). *Sphaerella punctiformis* (Pers. ex Fr.) Fuckel, proposed by the British committee as the lectotype, is a member of both Fries's subgenus and Fuckel's genus, and could be adopted — but only by conserving *Sphaerella* (Fr.) Fuckel against *Sphaerella* Ces. & Not.

On the showing of the British committee *Carlia Oxalidis* Rabenh., the monotype of *Carlia* Rabenh., is a nomen dubium, and the name *Carlia* therefore is not an alternative here.

To return to the original proposal, which was to conserve *Sphaerella* against *Mycosphaerella*: Except for Saccardo, who persisted in the indefensible use of *Sphaerella* as he did in so many other nomenclatorial and taxonomic absurdities, the greater part of recent and current usage favors *Mycosphaerella* (cf. BMS 1 p. 221, Miller 1941 p. 79, and Bisby). Since that name has the additional advantage of being valid, it should not be rejected merely to validate Saccardo's aberrations.

As indicated by a footnote in the Rules, the real intent of the motion is to conserve *Sphaerella* Ces. & Not. 1863 against *Sphaerella* Sommerf. 1824. The latter name is in current and general use for a genus of algae, and has been for so long a time that even if the fungus *Sphaerella* were not rejected as a later homonym it should be suppressed as "a permanent source of confusion or error" under Art. 62.

It is recommended that the proposal be rejected.

SPHAEROPSIS LÉV. vs. MACROPLODIA WESTEND. — IR p. 125; IRA p. 42; BMS 2 p. 287.

SPHAEROPSIS SACC. vs. SPHAEROPSIS LÉV. — BMS 2 p. 287.

Sphaeropsis Lév is a monotypic genus whose type species, on the authority of the B.M.S. committee, is an *Amphisphaeria*, an ascomycete; it therefore does not conflict with *Macroplodia*, a name given to a genus of fungi imperfecti. The first proposal should then be rejected.

Saccardo is said to have "recharacterized" *Sphaeropsis* in Michelia **2**: 105. He did not there publish a genus *Sphaeropsis*, however, but merely noted "Genus 'Sphaeropsis' hucusque vage definitum, limitetur ad species *Diplodiae* stylosporis fuscis jugiter continuis." In Syll. Fung. **3**: 291 he described "*Sphaeropsis* Lév. . . . emend., Sacc. Mich. II. p. 115." This is not publication of a new name, but misapplication of an old one (see discussion under *Acrothecium*). There is no genus *Sphaeropsis* Sacc. The second proposal must therefore be rejected also. On an earlier page, under *Amphisphaeria*, it is recommended that *Sphaeropsis* be rejected as a nomen ambiguum.

STAGONOSPORA (SACC.) SACC. vs. HENDERSONIA BERK. and PSILOTHECIUM FUCKEL — IR p. 125; IRA p. 42; BMS 2 p. 290.

In BMS are indicated errors appearing in IR, notably that the lectotype earlier proposed has nothing to recommend it. As modified by the B.M.S. committee the proposal seems both in order and useful; their recommendation for adoption is accordingly seconded. See notes under *Hendersonia*.

STEREUM PERS. EX FR. 1835 vs. AURICULARIA BULL. EX FR. 1825 and STEREUM FR. 1825. — Donk 1941 pp. 158, 178.

Stereum Pers. ex Gray, Nat. Arr. **1**: 652, is valid without conservation (see notes under *Hymenochaete*); and if it be typified by *S. hirsutum*, as is allowable, preserves the name in the application sought by the proposal, which is therefore unnecessary and should be rejected.

If there be no earlier valid designation of the type of *Stereum* Pers. ex Gray, *Stereum hirsutum* is hereby so designated.

STIGMATEA FR. vs. ASCOSPORA FR. — IR p. 122; IRA p. 43; Bisby p. 103.

Ascospora Fr. was published with the designated type *A. Aegipodii* (Pers. sub *Sphaeria* ex Fr., Syst. Mycol. **2**: 526. 1823.). The name *Stigmatea* is first found in Summ. Veg. Scand. 421, where it was published with the references "*Fl. Scan. Cord. IV f. 119.*" This seems separable (although no separation appears, l.c.) into a reference to Fries's Fl. Scan. and one to Corda's Icones. In Fl. Scan. 347. 1835 Fries published *Stigmea*; clearly *Stigmatea* is merely an improved spelling of the earlier generic name; "the original spelling . . . must be retained" (Art. 70). (For the comparable case of *Dermea* and *Dermatea*, see Groves, Mycologia **38**: 352–355. 1946). The complete Corda reference is Icones Fung. **4**: 41. pl. 8, fig. 119. 1840; the species is *Sphaeria Armeriae*, which Saccardo (Syll. **2**: 247)

treats as a form of *Pleospora herbarum*. Fries listed no species in 1835, and one must therefore look to the 1849 publication for the type of the genus. *Sphaeria Armeriae* is the logical choice, since Fries cites it as a basis for the genus; but it is not one of the list (said by Fries to be incomplete) of enumerated species. The one definite character ascribed to the genus in 1849 is "asci subtetraspori," and therefore an eight-spored species should not be designated as the lectotype. (The lectotype proposed in IR, *S. Robertiani*, is said by Saccardo to be octosporous).

The type of *Ascospora* has been transferred to *Stigmatea* as *S. Aegipodii* Oudem., and it may be that the genera conflict. But Bisby notes (without reference) that "*Ascospora* Fr. is said to be a nomen confusum." If that be true, *Ascospora* is automatically rejected, and *Stigmea* (rather than the variant spelling) will stand without conservation. Someone acquainted with the group should determine 1) which of the six species (or seven, including *Sph. Armeriae*) listed in 1849 under *Stigmatea* is the best lectotype of *Stigmea*, 2) whether *Sphaeria Aegipodii* Pers. ex Fr. is congeneric with that lectotype or is a nomen confusum, and 3) if it is congeneric, whether it is important to conserve *Stigmea*. No recommendation is offered here.

TEICHOSPORA FUCKEL VS. STRICKERIA KÖRB. and SPHAERIA FR. — IR p. 122; IRA p. 43; BMS 3 p. 285.

From the investigations carried out by the B.M.S. committee it appears that both *Teichospora* and *Strickeria* have been and are widely used, and that if there is any advantage it lies with the earlier name. Their recommendation that the proposal to conserve *Teichospora* be rejected is therefore seconded here.

The exact action implied by the recommendation in BMS "that *Sphaeria* Fr. emend. Ces. & de Not. be not restored" seems far from clear. However much or little Cesati and De Notaris have to do with it, the genus *Sphaeria* Haller ex Fr., Syst. Mycol. **2**: 319. 1823 (or Haller ex Gray, Nat. Arr. **1**: 526. 1821; or [Pers. ex] Hooker, Fl. Scot. **2**: 4. 1821) is one of the great classical genera of fungi, and not only "must be retained, or . . . must be re-established" (Art. 51), but should be, along with *Agaricus* (q.v.), *Clavaria*, *Thelephora*, *Boletus*, and others of comparable importance and venerability. The typification of this difficult genus may well be left to its special students. It is recommended that if *Teichospora* is conserved *Sphaeria* Fr. be deleted from the nomina rejicienda.

THYRSIDIUM MONT. EX DUR., Expl. Sci. Algérie Bot. **1**: 324. 1846–9 vs. CHEIROSPORA MONT. & FR., Syst. Orb. Veg. 365. 1825 — Ainsworth & Bisby 1943 p. 298, 1945 p. 318.

The name *Cheirospora* Mont. & Fr. was published by Fries in the addenda to the S.O.V., without mention of component species. Like other genera proposed in that work, it was discarded in vol. 3 of the Systema (index, p. 70); it evidently was based on material described in Syst. Mycol.

3: [484]. 1832 as *Stilbospora Cheirospora* — attributed to Fries alone in the index.

The name *Thyrsidium* was first mentioned by Montagne, who seems never to have heard of the genus *Cheirospora* published in his name, in Ann. Sci. Nat. Bot. ii **6**: 338. 1836. There he gave a brief description of *Stilbospora botryospora* Mont., under which he listed (apparently as a dubious synonym) "*S. cheirospora* Fr. Syst. Myc. 3. p. 484. An genus novum stilbosporeum sporidiis pedicellatis distinctum?" In the discussion which follows Montagne said ". . . on pourrait croire avoir sous les yeux des individus du *S. cheirospora* de Fries, si l'auteur ne distait formellement que les sporidies ne sont jamais cloisonnées." "Never" is strong language, especially when Fries did not so much as say "hardly ever." Fries wrote (l.c.), "Sporidia praecedentis [*Stilb. asterospermae*] similia. . . . Singulas non septatas vidi." Whatever one makes of Fries's grammar here, he seems to say that he "now and then saw spores that were not septate." On Montagne's showing, then, his species is probably the same as Fries's. But the genus is another matter. Montagne stated that he had at first intended to describe for his species a new genus to which he would have given the name *Thyrsidium*, but that after reflection he had preferred to refer it to *Stilbospora*. That is evidently not publication.

Thyrsidium next appears in Expl. Sci. Algérie Bot. **1**: 324, 325. There Durieu, presumably with the collaboration of Montagne (cf. p. [i]) described *Thyrsidium* Mont. & *T. hederaecolum* (Not.) Dur., with the note "En même temps que M. le Dr Montagne publiait son *Stilbospora botryospora*, il faisait remarquer que sa plante pouvait être considérée comme le type d'un genre nouveau pour lequel il proposait le nom de *Thyrsidium*. Ce nom a donc incontestablement la priorité sur celui de *Hyperomyxa*, par lequel M. Corda a désigné postérieurement le même genre. . . ." Of course Montagne did no such thing; he wrote that after reflection he had changed his mind about publication of *Thyrsidium*.

Hyperomyxa Corda, Icon. Fung. **3**: 34. 1839 was published for the single species *H. Stilbosporoides*, which Durieu (l.c.) makes a synonym of "*Thyrsidium botryosporum* Montag." (thus incidentally first publishing the binomial for Montagne's type species). According to Montagne, then, *Cheirospora* Fr. and *Thyrsidium* Mont. are probably obligate synonyms; according to Durieu *Thyrsidium* and *Hyperomyxa* are obligate synonyms. Durieu further makes *Myriocephalum* Not., R. Accad. Sci. Torino Mem. Cl. Mat. Fis. ii **7**: 13. 1842; Corda Anleit. 192. 1842, a synonym, and incorporates its only species in *Thyrsidium*. Allowing the identity of all these generic names, *Cheirospora* 1825, *Hyperomyxa* 1839, *Myriocephalum* 1842, and *Thyrsidium* 1846–9, Saccardo adopts the latest of them, *Thyrsidium*, and fails to account in any way for *Stilbospora Cheirospora* (Syll. Fung. **3**: 761. 1884).

So much is paper-work. The nomenclatorial history of the genus is a series of bunglings worthy of the attention of C. G. Lloyd. Anyone who

desires to immortalize the latest will have to propose conservation of *Thyrsidium* against three other names. No recommendation is offered here.

TOMENTELLA PERS. EX PAT. VS. HYPOCHNUS FR. — IR p. 123; IRA p. 43; Donk 1933 p. 27; Rogers 1939 p. 305; BMS 1 pp. 225, 232.

TOMENTELLA PERS. EX PAT. VS. CALDESIELLA SACC. — Rogers 1939 p. 306; BMS 1 p. 232; Donk 1941 pp. 158, 179.

Since *Hypochnus* (q.v.) is strictly a genus of the Lichenes, it does not conflict with *Tomentella*, which therefore need not be conserved against it. The first proposal should be rejected.

Since *Tomentella* is a large and important genus and *Caldesiella* a small and little-known one, it appears to be agreed that the former name should be conserved.

TREMATOSTOMA (SACC.) SHEAR VS. CLYPEOTHECIUM PETR. — Shear 1942 p. 272.

The author of the proposal has first raised Saccardo's subgenus *Trematostoma* to generic rank and then, on the same page, proposed to conserve it against the twenty-year-old genus *Clypeothecium*. The only reason given is that *Trematostoma* "is the preferable name." According to Art. 59 "a name . . . must not be rejected . . . merely because . . . another is preferable." Moreover, since under the Rules conservation is provided for "to avoid disadvantageous changes in the nomenclature of genera" the proposal is quite out of order. If "fixity of names" is one of the two "essential points of nomenclature" (Art. 4), the proposal should be rejected.

TREMELLA PERS., Mycol. Eur. **1**: 98. 1822 — Type: *T. mesenterica* Pers., l.c. p. 99 — VS. TREMELLA DILL. EX GRAY, Nat. Arr. **1**: 593. 1821, and GYRARIA NEES EX GRAY, Nat. Arr. **1**: 593. 1821.

The type (monotype) of *Tremella* Gray is *T. recisa*, now universally placed in the genus *Exidia*. *Gyraria* in Gray's work contains twelve species; but since it is written "*Gyraria* Esenbeck," and its first species, *G. mesenterica*, is the only one of Nees von Esenbeck's species included, that should be its type. If these two genera of Gray's are not rejected, then, *Tremella* becomes the name of all exidias, and *Gyraria* the name of all species congeneric with *Gyraria* (= *Tremella*) *mesenterica*. It is therefore hereby proposed that *Tremella* Pers. be conserved, as indicated in the heading to this paragraph.

TREMELLODON (PERS.) FR. VS. HYDNOGLOEA CURREY — Donk 1941 p. 158, 179; Martin 1948 p. 117.

It should be noted that the generic name *Tremellodon*, 1874, is antedated not only by *Hydnogloea*, 1871, but also by *Pseudohydnum* Karst., Not. Faun. Fl. Fenn. **9**: 374. 1868 (num *Pseudohydnum* Rick, Ann. Mycol. **9**: 409. 1904?), which similarly is typified by *Hydnum gelatinosum*. There is no doubt, then, of their synonymy, nor that under the rules the well-known name *Tremellodon* must be superseded by the little-known *Pseu-*

dohydnum. The only question is whether conservation should be invoked on behalf of a monotypic genus of no particular importance. It is here recommended that it not be, and that the proposal be rejected. Although Donk recommends adoption of this proposal, he several times rejects similar ones on grounds of the small number of species involved. The same recommendation of rejection is offered elsewhere in this paper concerning *Cienkowskia*, *Cladoderris*, *Hypolyssus*, *Macowanites*, and *Mastomyces*. The decision finally adopted in one of these cases should govern all. If *Tremellodon* were to be conserved, *Pseudohydnum* should be included among the nomina rejicienda. Dr. G. W. Martin is using the name *Pseudohydnum* for the genus in question.

TRICHOLOMA QUÉL. vs. GYROPHILA QUÉL. and MONOMYCES EARLE — IR p. 124; IRA p. 43; BMS 1 p. 229; Donk 1941 pp. 158, 180; Singer & Smith 1946 pp. 259, 277, 293.

TROCHOLOMA (FR). QUÉL. vs. TRICHOLOMA BENTH. — BMS 1 p. 229; Donk 1941 pp. 158, 180.

The very strong case made out for the conservation of *Tricholoma* by the B.M.S. committee and by Donk is supported by Singer & Smith also. The arguments in BMS for the designation of *T. rutilans* as lectotype and by Donk for *T. imbricatum* seem to be somewhat more cogent than that of Singer & Smith, since *A. flavovirens*, nominated by the latter authors, was later removed by Fries from the section which he called *Genuina*. But on nomenclatorial grounds any of the three would be acceptable, and the choice should be left for agreement among agaricologists. Since *Gyrophila* and *Monomyces* are later than *Tricholoma*, the latter need not be conserved against them, but only against Bentham's earlier homonym. The first proposal should then be rejected and the second adopted.

Tricholoma (Fr.) Quél. was published in Soc. Émul. Montbéliard Mém. ii **5**: 76 (and should be so cited) and in Ch. Jura Vosges 38. See note under *Flammula*.

TRICHOSPORIUM FR. vs. COLLETOSPORIUM FR. and ALYTOSPORIUM FR. — IR p. 126; IRA p. 43.

The genus *Trichosporium* was first described by Fries in 1825 (Syst. Orb. Veg. 306), without enumeration of species. When he again referred to it, in Summ. Veg. Scand., he equated it to "Sporotrichum sect. 1. *S.M.*", noting "jam in S.O.V.O. a Botryti distinxi; at in S. M. cum Sporotricho tamquam peculiarem sectionem junxi." That "special section," marked by one asterisk, includes six species, *S. nigrum*, *S. geochroum*, *S. cinereo-virens*, *S. olivaceum*, *S. elaeochroum*, and *S.* ? *turbinatum* (Syst. Mycol. **3**: 416–417). All of these except the last (which Fries marked with an interrogation point), and *S. geochroum* Desm., form a part of *Trichosporium* as Fries first enumerated its species in Summ. Veg. Scand.; and even the Desmazières species may be what is there listed as "*S. geotrichum* (Desmaz.)." From the four (or perhaps five) species forming a part of both

the "special section" and the genus the type of the latter should be chosen. The species proposed in IR as lectotype, *T. murinum* (Fr.) Sacc., formed a part neither of the section cited nor of the genus *Trichosporium* as Fries conceived it, and therefore is not eligible.

Colletosporium Lk. in Linn. Sp. Pl. 5 ed. (Willd.) **6(1)**: 25. 1824 was published for two species, *C. umbrinum* and *C. atrum*. The "Fr. ex Link" citation in IR is nonsense; what appears in Fries, in the place cited in IR, is "*Mycelia saepe luxuriantia Hymenomycetum*: . . . Celletosporium Link? mihi non certe notum, sed adsunt Thelephorae status quibus convenit character." Fries did describe the genus, apparently from Link's account, in S.O.V. 304. Link's genus was again described, with its two species, in Wallroth, Fl. Crypt. Germ. **2**: 316. 1833. Whether or not genera of hyphomycetes were validly published before 1832, then, *Colletosporium* Lk. (or Lk. ex Wallr.) has priority.

Alytosporium Lk. in Linn. Sp. Pl. 5 ed. (Willd.) **6(1)**: 23. 1824 included five species, *A. fuscum* (Pers.), *A. fulvum* (Lk.), *A. croceum* (Kunze), *A. psittacinum* (Lk.), and *A. murinum* (Lk.). Of these the first is a synonym of *Tomentella fusca*; on the ground that that species has already been removed from *Alytosporium*, and that its employment as the type of Link's genus would create an unnecessary and inconvenient synonymy with *Tomentella*, *A. fuscum* should be excluded from consideration as a lectotype. There appears to be no published record of the recent examination of Persoonian material of *fuscum*, but the general opinion is that its assignment to *Tomentella* is probably correct. Saccardo has it both ways: in Syll. Fung. **4**: 239 he makes *Corticium fuscum* Pers. and *Thelephora vinosa* Pers. synonyms of *Trichosporium fuscum* (Pers.) Sacc.; in Syll. Fung. **6**: 613 he lists them both under *Corticium fuscum* — which is absurd. If, as here recommended, *A. fuscum* (Fr.) Link is held not to be the type of Link's genus, one connection between *Trichosporium* Fr. and *Alytosporium* Lk. is broken. Of Link's remaining four species one other was transferred by Saccardo to *Trichosporium* — *A. murinum* (Lk. sub *Sporotrich.*) Lk. In the 1824 work under discussion Link cites his *Sporotrichium murinum* twice — once on p. 24, where reference is made to publication in Mag. Ges. Naturf. Fr. Berlin **7**: 35. 1815, and where *S. murinum* is transferred to *Alytosporium*; and once on p. 6, where reference is made to publication in Jahrb. Gewächsk. **1**: 173. 1820, and where *S. murinum* is described as a sporotrichum. It is submitted that *S. murinum* Lk. is a nomen ambiguum (as well as a nomen dubium). If it be considered the type of *Alytosporium*, that name is likewise a nomen ambiguum et dubium, and being therefore rejected, does not interfere with the use of the name *Trichosporium*. If it is not the type of *Alytosporium*, that genus and *Trichosporium* need not conflict.

So much is paper-work. Whether there is any particular advantage to be gained from the conservation of *Trichosporium* (with one of the eligible species as type) against *Colletosporium* is a taxonomic judgment, and is left to students of hyphomycetes.

TUBERCULARIA FR. EX TODE VS. KNYARIA KUNTZE — IR p. 126; IRA p. 43; BMS 1 p. 231.

TUBERCULARIA TODE EX FR. VS. TUBERCULARIA WIGGERS — BMS 1 p. 231.

Tubercularia Tode was described in Gray, Nat. Arr. **1**: 547. 1821; in Hooker, Fl. Scot. **2**: 9. 1821 (with implied attribution to Persoon; cf. p. [3], footnote b); in Link, Linn. Sp. Pl. 5 ed. (Willd.)**6**(**2**): 99. 1825; in Fries, Syst. Orb. Veg. 173. 1825; in Sprengel, Linn. Syst. Veg. 16 ed. **4**(**1**): 564. 1827; in Duby, Bot. Gal. 2 ed. 879. 1830; and in Fries, Syst. Mycol. **3**(**2**): 463. 1832. For determining the status of the genus it does not matter which is regarded as the valid publication: *T. vulgaris* is a principal (and usually the first) component of the genus, whoever published it, and should surely be the type. *Tubercularia* Wiggers has no currency whatever, and there appear to be no obstacles to the conservation of *Tubercularia* Tode ex [anyone], as recommended in BMS; a second to that recommendation is here offered. *Knyaria*, which is much later than *Tubercularia*, need not be formally rejected.

UROCYSTIS RAB. VS. TUBURCINIA FR. — BMS Pl. Path. Comm.; BMS 1 p. 223; Zundel et al.

Urocystis is said to have been published "in Klotzsch, Herb. viv. mycol. ed. 2, no. 393. (1856)." What appears to be this number in the New York Botanical Garden herbarium bears this label: "Rabenhorst. Herb. mycologicum. Ed. II. / 393. Urocystis occulta (Wallr.) Rabenh. / Schlecht. in bot. Zeit. 1852 p. 601. / Dresdae, ad Secales culmos vaginasque, haud infrequens. / NB. *Polycystis* (Lév.) est Algarum genus. L.R." This is evidently an obscure and oblique way to publish a genus; but it can be inferred 1) that Rabenhorst intended to publish as a new generic name the first element of the binomial with which he tagged his specimen; 2) that it was to be a substitute for *Polycystis* Lév., and that the author wished to say that *Polycystis* Lév. was *not* the homonymous genus of algae. If in addition it be allowed that the "(Lév.)" on Rabenhorst's label is a "reference" (Art. 37) to Léveillés "previously and effectively published description," *Urocystis* is there published. Otherwise, it must be cited as in some other place — perhaps as Rab. ex Fuckel, Symb. Mycol. 40. 1870. In either event its type should be *U. occulta*.

Polycystis Kütz. was published in Tab. Phycol. **1**: 7. 1846 (Jan.) in a note headed "Die Gattung Microcystis muss eigentlich in drei Gattungen gespalten werden, die ich vorläufig als Unterabtheilungen hier anführe, nämlich: . . . 3. Polycystis [Diagnosis follows.] Hierher: M. elabens. M. aeruginosa. M. ichthyoblabe." That is, *Polycystis* of the algae was described tentatively, and for an "Unterabtheilung" of *Microcystis*. Even if it was published earlier than *Polycystis* Lév., Ann. Sci. Nat. Bot. iii **5**: 269. 1846, which is very likely but not certain, it does not invalidate Léveillé's generic name, since if published at all it was published for a group of different rank. Léveillé's name is then valid; its type is *P. Pompholygodes* (Wallr.) (= *Urocystis Anemones*).

Since *Urocystis* is a name widely used for an important genus, its conservation, already recommended by the B.M.S. and American Phytopath. committees, is highly desirable. It is here recommended that the proposal be adopted in the following form:

Urocystis Rab. ex Fuckel, Symb. Mycol. 40. 1870. — Type: *Erysibe occulta* Wallr., Fl. Crypt. Germ. **2**: 212. 1833 — vs. *Polycystis* Lév., Ann. Sci. Nat. Bot. iii **5**: 269. 1846 and *Tuburcinia* Fr., Syst. Mycol. **3**: 439. 1832.

UROMYCES TUL. vs. NIGREDO ROUSSEL and CAEOMURUS GRAY.

UROMYCES (LINK) UNGER vs. NIGREDO ROUSSEL, CAEOMURUS (LINK) GRAY and PUCCINOLA MARCH. — IR pp. 122, 126, 127; IRA p. 43; BMS 1 p. 222.

As the BMS committee has pointed out, Link assigned to *Uromyces* the rank of subgenus (Ges. Naturf. Freunde Berlin Mag. **7**: 28. 1815); the committee has contended, however, that because Link made binomials with the subgeneric name plus an epithet "he used [his subgenera] as genera," and that "these binary combinations may be regarded as giving the date of the generic name." It is here submitted, on the other hand, that such illegitimate (Art. 27) binomials affect the status of the subgeneric name in no way, and merely bring about the rejection of both the binomials and the epithets as so used by Link (Art. 60). Although it is unsafe to be too confident in such matters, it appears that *Uromyces* was first published by Unger, as cited in IR. In that case it is antedated by the three genera there listed as nomina rejicienda.

There can be little disagreement with the BMS recommendation that the proposal for conservation of *Uromyces* be accepted; that recommendation is here seconded.

VENTURIA NOT. vs. ? — Bisby & Mason p. 172; Ainsworth & Bisby 1943 p. 316, 1945 p. 337.

VENTURIA NOT. — Type: C. inaequalis (Cke.) Wint. — vs. ENDOSTIGME SYD. — Shear 1948.

The case is both presented and refuted in a sentence in the place first cited: "The name *Venturia* should be conserved to continue its current use, which includes neither of the original species." H. Sydow (Ann. Mycol. **21**: 170–1. 1923) has a pungent account of the history of the genus, which should be read by all admirers of C. G. Lloyd and all faithful adherents of the Rules. Briefly, *Venturia* has two original species; both of these Saccardo transferred out of *Venturia*, and one he made the type of a new genus *Protoventuria*, citing *Venturia* as a synonym (Syll. Fung. **9**: 741. 1891); the name *Venturia* he retained for various fungi. Ainsworth & Bisby have "*Venturia* de Not. . . . Conservation necessary." One may agree that *Venturia* Not. should be retained without agreeing to conservation; for *Venturia* Not. stands without conservation.

Shear presents a more detailed discussion, in which he states that "the

name should be conserved and typified by a species representing the most general current usage"; "it is perhaps better to take *V. inaequalis* as the type." From his paper the second proposal listed above has been assembled. *Endostigme* is listed as the nomen rejiciendum because on Shear's showing it provides the valid generic name for the fungus commonly called *V. inaequalis*; it should, however, be noted that *Endostigme* was published (Ann. Mycol. **21**: 173) without designation of a type, and that while Shear treats *E. inaequalis* as the [lecto]type, Clements & Shear earlier (Gen. Fungi 268. 1931) designated *E. ditricha* (Fr.) as the type. Shear states also that "the specific epithet *cinerascens* is invalid for the apple scab fungus since *Sphaeria cinerascens* Fckl. is a later homonym of *Sphaeria cinerascens* Schw." This would be true if the Rules were reasonably straightforward and logical; but it appears that *Sphaerella cinerascens* Fuckel ex Rabenh., Fung. Eur. 845 and Hedwigia **4**: 158. 1865, is valid under Art. 69 ("an author may, if he wishes, adopt an epithet previously given to the group in an illegitimate combination"), and must furnish the epithet for the species.

It is recommended that both proposals be rejected, since both are unnecessary and the second is, as to typification, impossible. Although it is not here recommended, it would be possible under the present Art. 47 (for which see discussion under *Phoma*) to conserve *Venturia* Sacc., Syll. Fung. **1**: 586. 1882, non Not. — Type: *V. inaequalis* (Cooke) — vs. *Endostigme* Syd., thus commemorating and perpetuating one more of Saccardo's blunders that had best be forgotten.

VOLVARIA (FR.) QUÉL. VS. PSEUDOFARINACEUS EARLE — IR p. 124; IRA p. 43.

VOLVARIA (FR.) QUÉL. VS. VOLVARIA DC. — BMS 1 p. 230; Donk 1941 pp. 159, 181.

VOLVARIA (FR.) QUÉL. VS. VOLVARIOPSIS MURR. — Singer & Smith 1946 pp. 261, 293.

Since *Pseudofarinaceus* Earle is antedated by Kuntze's use of the same name for a different group, it must be rejected, even without conservation. Since both *Pseudofarinaceus* and *Volvariopsis* are antedated by *Volvaria* (Fr.) Quél., the latter need not be conserved against either. If conservation is to be authorized, it must be against *Volvaria* DC., a lichen genus. The B.M.S. committee and Donk have recommended conservation. Singer & Smith state that "since Murrill has made most of the important transfers to *Volvariopsis*, we are not convinced that the conservation of *Volvaria* is really vital." This principal, that conservation should not be recommended "merely because . . . [a name] is preferable or better known" (Art. 59), is entirely in accord with Art. 21, where conservation is provided "to avoid disadvantageous changes in the nomenclature of genera." Preclusive conservation, like that proposed for *Aleurodiscus, Calvatia, Clavaria, Conocybe, Tomentella, and Tremella*, is to be strongly recommended; where the alternative name and the binomials under it have al-

ready been published, conservation does not "avoid disadvantageous changes" and should be used very sparingly. It is certain that, even so, strong pressure will bring about the conservation of names less profitably retained, and it has not seemed possible to apply the principle in question in all the recommendations offered in these notes; but it should nevertheless be recognized and applied as often as possible. It is here recommended that the proposal be rejected.

Volvaria (Fr.) Quél. was published in Soc. Émul. Montbéliard Mém. ii **5**: 114 (and should be so cited) and in Ch. Jura Vosges 80. See note under *Flammula*.

II. NOMINA CONFUSA

The names of fungi here listed have been declared nomina confusa (cf. Art. 64). Specific names are given first, and afterwards generic names. For the former, references are given to the published evidence (except for *Corticium ferax*, not previously reported to be a nomen confusum); for the latter, the evidence must be the "confused" nature of the type species, and the list of specific names should be consulted. Citations for generic names are omitted when they are the same as those given for the genotypes. Four other generic names are given as nomina confusa in Ainsworth & Bisby 1943 — *Ascospora* Fr. on p. 22, *Dictyochora* Theiss. & Syd. on p. 87, *Monotospora* Corda on p. 187, and *Winterina* on p. 318; the pertinent evidence for these is not at hand. Many of the names have been taken from the Ainsworth & Bisby *Dictionary of the Fungi*.

For a proposed clarification of Art. 64, see Mycologia **40**: 635–637. 1948.

NOMINA SPECIFICA CONFUSA

CORTICIUM FERAX ELL. & EVERH., Am. Naturalist **31**: 339. 1896. The type consists of *Platygloea Peniophorae* Bourd. & Galz. and its substratum, a resupinate thelephoraceous fungus. The description embraces both components inseparably.

DARWINIELLA ANTARCTICA SPEG., Fung. Fueg. 105. 1887; Acad. Nac. Cienc. Cordoba Bol. **11**: 237. 1887. Cf. Petrak & Sydow, Ann. Mycol. **34**: 22. 1936.

EPHELIDIUM AURANTIORUM SPEG., Soc. Cient. Argentina An. **90**: 184. 1920. Cf. Petrak & Sydow, Ann. Mycol. **33**: 182. 1935.

GAMOSPORELLA HYSTERIOIDES SPEG., Soc. Cient. Argentina Anal. **26**: 63. 1888. Cf. Petrak & Sydow, Ann. Mycol. **33**: 160. 1935.

HETEROBASIDIUM CHLORASCENS MASS., Linn. Soc. Bot. Jour. **25**: 128. 1889. Cf. Lloyd, The Myths of Mycology, p. 15. 1917.

HYMENOBOLUS PARASITICUS ZUKAL, Österr. Bot. Zeits. **43**: 73. 1893. Syn.: *Hymenobolina parasitica* (Zukal) Zukal, Österr. Bot. Zeits. **43**: 133. 1893. Cf. Keissler, Naturhist. Mus. Wien Ann. **39**: 194. 1925; Santesson, Svensk Bot. Tidskr. **42**: 46. 1948.

HYPOLYSSUS UNDULATUS PERS., Mycol. Eur. **2**: 6. 1825; H. VENTRICOSUS Pers., l.c. p. 7. Cf. Fries, Linnaea **5**: 701. 1830; Kuntze, Rev. Gen. Pl. **3(2)**: 487. 1898; Donk, Buitenzorg Bot. Gard. Bul. iii **17**: 195. 1941.

HYPORHAMMA RETICULATUM SENSU CORDA, Icones **6**: 13. 1854. Cf. Martin, Mycologia **40**: 125. 1948.

LANGLOISULA SPINOSA ELL. & EVERH., Jour. Mycol. **5**: 68. 1889. Cf. Rogers & Jackson, Farlowia **1**: 292. 1943.

LASIOPHOMA MAYDIS (SPEG.) SPEG., Physis **4**: 290. 1918. Syn.: *Chaetophoma Maydis* Speg., Soc. Cient. Argentina Anal. **22**: 190. 1886. Cf. Petrak & Sydow, Ann. Mycol. **34**: 33. 1936.

MUCIPORUS CORTICOLA JUEL, Bih. Sv. Vet.-Akad. Handl. **23**, Afd. 3 (12): 23. 1897; M. DELIQUESCENS Juel, l.c. p. 24. Cf. Juel, Ark. f. Bot. **14**(1): 1–9. 1916; Rogers, Bot. Gaz. **94**: 87. 1932; Donk, Buitenzorg Bot. Gard. Bul. iii **17**: 195. 1941.

PENIOPHORA ADMIRABILIS BURT, Mo. Bot. Gard. Ann. **12**: 304. [1926]. Cf. Rogers & Jackson, Farlowia **1**: 310. 1943.

PHYLLONOCHOETA SOLANI FRAG. & CIF., Repub. Domin. Estac. Agron. Moca Publ. ser. B. **8**: 43. 1927; R. Soc. Españ. Hist. Nat. Bol. **27**: 171. 1927 (not seen). Cf. Petrak, Ann. Mycol. **32**: 363. 1934.

PHYSALOSPORELLA CHILENSIS SPEG., La Plata Univ. Nac. Fac. Agron. Veter. Rev. **6**: 35. 1910. Cf. Petrak & Sydow, Ann. Mycol. **32**: 28. 1934.

THELEPHORA CALCEA PERS. * GLEBULOSA FR., El. Fung. **1**: 215. 1828. Syn.: *Corticum glebulosum* (Fr.) Bres., Fung. Trid. **2**: 61. 1898; *Peniophora glebulosa* (Fr.) Sacc. & Syd., Syll. Fung. **16**: 195. 1902; *Kneiffia glebulosa* (Fr.) Bres., Ann. Mycol. **1**: 104. 1903; *Peniophora cretacea* Bourd. & Galz., Hym. France 288. [1928]. Cf. Rogers & Jackson, Farlowia **1**: 284. 1943.

TRACHYTHYRIOLUM BRASILIANUM SPEG., Acad. Nac. Cienc. Cordoba Bol. **23**: 523. 1919. Cf. Petrak & Sydow, Ann. Mycol. **33**: 171. 1935.

TRICHOCHORA MARGINATA (THEISS.) THEISS. & SYD., Ann. Mycol. **13**: 289. 1915. Syn.: *Ophiodothis marginata* Theiss. Ann. Mycol. **10**: 10. 1912. Cf. Petrak, Ann. Mycol. **27**: 324. 1929.

NOMINA GENERICA CONFUSA

DARWINIELLA SPEG. Monotype: *D. antarctica* Speg.

EPHELIDIUM SPEG. Monotype: *E. aurantiorum* Speg.

GAMOSPORELLA SPEG. Monotype: *G. Hysterioides* Speg.

HETEROBASIDIUM MASS., Linn. Soc. Bot. Jour. **25**: 127. 1889. Monotype: *H. chlorascens* Mass.

HYMENOBOLINA ZUKAL. Monotype: *Hymenobolus parasiticus*.

HYPOLYSSUS PERS. Based on *H. undulatus* Pers. & *H. ventricosus* Pers. See discussion under *Hypolyssus* among the nom. cons. prop.

? HYPORHAMMA CORDA. The generic description is based on *H. recticulatum* sensu Corda; *H. reticulatum* sensu Corda is a nomen confusum. The nomenclatorial type of that species, *Trichia reticulata* Pers., is legitimate.

HYPOSPILA FR., Syst. Orb. Veg. 109. 1825. Listed by Ainsworth & Bisby 1943, p. 145, as a nomen confusum, with reference to BMS 3 p. 284. What the B.M.S. committee stated is that "the name . . . has been . . . confused" — i.e., that it is a nomen ambiguum. Petrak & Sydow (Ann. Mycol. **21**: 369. 1923) report that the type specimen of *Spiloma inustum* Ach., the species designated by Fries, l.c., as the type of *Hypospila*, shows "keine pflanzliche Bildung." *Hypospila* Fr. is then neither a nomen confusum nor a nomen ambiguum (Art. 62), but a nomen dubium. It is *Hypospila* sensu Auctt. which is ambiguous, and Auctt. var. who are confused.

LANGLOISULA ELL & EVERH. Monotype: *L. spinosa* Ell. & Everh.

LASIOPHOMA SPEG. Type: *L. Alliicola* (Tassi) Speg. — Petrak & Sydow in selecting a type for Spegazzini's genus excluded three of its five species from consideration, on the grounds that Spegazzini did not know them, and chose *L. Maydis* (q.v.) as lectotype. Since they regarded this as a nomen confusum, they stated that *Lasiophoma* "ist zu streichen." In publishing the genus, however, Spegazzini clearly designated *L. Alliicola* as the type; the genus stands or falls then with this species, which seems not to have been shown to be "confused," rather than with *L. Maydis*.

MELIOLINOPSIS BEELI, Bot. Jard. Bruxelles Bul. **7**: 101. 1920. — Ainsworth & Bisby 1943 p. 175 cite Stevens, Ann. Mycol. **26**: 285. 1928, as authority for the statement that this is a nomen confusum. Stevens's statement, l.c. p. 286, is "that many if not all of these 8-spored forms will . . . prove to be Pyrenomycetes parasitic upon Meliolas, and that the existing accounts confuse in description the Meliola host and the 8 spored parasite." But Stevens has already asserted that the generic type designated by Beeli lacks certain characters attributed to the genus, and has sought to exclude the type from the genus. Of course when such a discrepancy appears it is the description, not the type, which must be altered. Whether or not *Meliolinopsis* Beeli is a nomen confusum depends on the nature of *M. octospora* (Cke.), the type, upon which no testimony appears.

MUCIPORUS JUEL. Based on *M. corticola* Juel & *M. deliquescens* Juel. Often incorrectly cited as a synonym of *Tulasnella*, as in Ann. Mycol. **31**: 183 et seq.

PERICONIA TODE EX FR., Syst. Mycol. **3**(2): 307. 1832. Listed by Ainsworth & Bisby 1943 p. 216, 1945 p. 231 as a nomen confusum, with reference to Mason 1941. Although according to Mason (1941 p. 123) *Periconia* might be considered a nomen dubium, as defined by Art. 63, or a nomen ambiguum, as defined by Art. 62, there is no evidence presented that its characters "were derived from two or more entirely dis-

cordant elements . . . erroneously supposed to form part of the same individual"; it is therefore not a nomen confusum under Art. 64.

PHYSALOSPORELLA SPEG. Type: *P. chilensis* Speg.

SOPPITTIELLA MASS., Brit. Fung.-Fl. **1**: 106. 1892. — Listed by Ainsworth & Bisby 1943 p. 277 as a nomen confusum. It may well be that one or more of Massee's species consisted of two organisms mistakenly thought to be one; it is hard to account for some of the published characters on any other supposition. In Mycologia **36**: 78. 1944 *S. cristata* ([Pers.] ex Fr.) Mass. was designated as the lectotype; on that basis, *Soppittiella* would be not a nomen confusum, but a synonym of *Sebacina* Tul. Ainsworth & Bisby have so listed it in 1945 p. 295.

TRACHYTHYRIOLUM SPEG. Monotype: *T. brasilianum* Speg.

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III. REFERENCES

Ainsworth, G. C., & Bisby, G. R. A dictionary of the fungi. viii + 359 pp. Imp. Mycol. Inst., Kew, 1943; 2 ed. vii + 431 pp. 1945.

Bisby, G. R. An introduction to the taxonomy and nomenclature of fungi. vii + 117 pp. Imp. Mycol. Inst., Kew, 1945.

Bisby, G. R., & Mason, E. W. List of pyrenomycetes recorded for Britain. Brit. Mycol. Soc. Tr. **24**: 127–243. 1940.

Boedijn, K. B., & Steinmann, A. Les espèces des genres *Helicobasidium et Septobasidium* des Indes Néerlandaises. Buitenzorg Jard. Bot. Bul. iii **11**: 165–219. 1931.

Briquet, J., et al. International rules of botanical nomenclature. 3 Ausg. xi + 151 + i pp. Fischer, Jena, 1935.

British Mycological Society. Nomenclature Committee. Nomina generica conservanda . . . . I. Brit. Mycol. Soc. Trans. **23**: 215–232. 1939. II. Brit. Mycol. Soc. Trans. **23**: 281–292. 1939. III. Brit. Mycol. Soc. Trans. **24**: 282–293. 1940.

[**British Mycological Society. Plant Pathology Committee.**] Urocystis versus Tuburcinia. Brit. Mycol. Soc. Trans. **23**: 214. 1939.

Cain, R. F. Studies of coprophilous Sphaeriales in Ontario. Univ. Toronto Studies Biol. Ser. 38. 126 pp. 1934.

Cain, R. F., & Groves, J. W. Notes on seed-borne fungi. VI. Sordaria. Can. Journ. Res. **26C**: 486–495. 1948.

Camp, W. H., Rickett, H. W., & Weatherby, C. A., [eds.] International rules of botanical nomenclature. Brittonia **6**: 1–120. 1947.

Conant, N. F. The taxonomy of the anascosporous yeast-like fungi. Mycopath. **2**: 253–266. 1940.

Cooke, W. B. A nomenclatorial survey of the genera of pore fungi. Lloydia **3**: 81–104. 1940.

Couch, J. N. The genus *Septobasidium*. [x] + 480 pp. Univ. N. Car. Press, Chapel Hill, 1938.

Cunningham, G. H. The gasteromycetes of Australia and New Zealand. xv + 236 pp. Mc Indoe, Dunedin, n.d. [?1942].

Dodge, C. W. Medical mycology. 895 pp. Mosby, St. Louis, 1935.

Donk, M. A. Revision der Niederländischen Homobasidiomycetae-Aphyllophoraceae II. Nederl. Mycol. Ver. Med. **23**: 1–278. 1933.

Donk, M. A. Nomina generica conservanda and confusa for Basidiomycetes (Fungi). Buitenzorg Bot. Gardens Bul. iii. **17**: 155–197. 1941.

Doty, M. S. Proposals and notes on some genera of clavarioid fungi and their types. Lloydia **11**: 123–138. 1948.

Fitzpatrick, H. M. The lower fungi. Phycomycetes. pp. xi + 331. McGraw-Hill, New York, 1930.

Lütjeharms, W. J. Conservation of later generic homonyms: *Rhipidium* Cornu versus *Rhipidium* Auct. Blumea **2**: 327–328. 1937.

Martin, G. W. The application of the generic name *Guepinia*. Amer. Jour. Bot. **23**: 627–629. 1936.

Martin, G. W. New or noteworthy fungi from Panama and Colombia. II. Mycologia **30**: 431–441. 1938.

Martin, G. W. The generic name *Auricularia*. Amer. Midl. Nat. **30**: 77–82. 1943.

Martin, G. W. New or noteworthy tropical fungi. IV. Lloydia **11**: 111–122. 1948.

Mason, E. W. Annotated account of fungi received . . . List II (Fascicle 2). pp. 1–67. Imp. Mycol. Inst., Kew, 1933.

Mason, E. W. . . . (Fascicle 3 — special part). pp. 101–144. - - - - - 1941.

Melin, E., & Nannfeldt, J. A. Researches into the blueing of ground wood-pulp. Svensk. Skogsv. Tidskr. **32:** 397–616. 1934.

Miller, J. H. British Xylariaceae. II. Brit. Mycol. Soc. Trans. **17**: 125–145. 1932.

Miller, J. H. Georgia pyrenomycetes. II. Mycologia **33**: 74–81. 1941.

Morse, E. E. Variation in Montagnites arenarius (DC.). Mycologia **40**: 255–261. 1948.

Ramsbottom, J. Notes on the nomenclature of fungi. Jour. of Bot. **54**: 76–80. 1916.

Ramsbottom, J. *Macowania*, *Hypochanum*, or *Macowanites*? Brit. Mycol. Soc. Trans. **25**: 336–337. 1942.

Rehder, A., Weatherby, C. A., Mansfeld, R., & Greene, M. L. Conservation of later generic homonyms. Kew Bul. Mis. Inf. **1935**: 341–544. 1935.

Rogers, D. P. The genus Hypochnus and Fries's Observationes. Mycologia **31**: 297–307. 1939.

Rogers, D. P. The meaning of Article 57 of the International Rules. Mycologia **40**: 240–254. 1948.

Shear, C. L. List of names of genera of fungi proposed for conservation by —. [multigraphed; no date or place] 11 pp.

Shear, C. L. Mycological notes. VI. Mycologia **34**: 263–273. 1942.

Shear, C. L. Conserving names of fungi. Mycologia **35**: 267–271. 1943.

Shear, C. L. Mycological notes. IX. Mycologia **40**: 748–759. 1948.

Singer, R. Notes on Farlow's Agaricales from Chocorua. Farlowia **2:** 39–51. 1945.

Singer, R., & Smith, A. H. Proposals concerning the nomenclature of the gill fungi including a list of proposed lectotypes and genera conservanda. Mycologia **38**: 240–299. 1946.

Singer, R., & Smith, A. H. Emendation to our proposals concerning the nomenclature of the gill fungi. Mycologia **40**: 627–629. 1948.

Sparrow, F. K. Aquatic phycomycetes. xix + 785 pp. Univ. Mich. Press, Ann Arbor, 1943.

Wakefield, E. M. The genus Cystopus in South Africa. Bothalia **2**: 242–246. 1927.

Wheeler, L. C. Agaricus versus Psalliota. So. Calif. Acad. Sci. Bul. **45**: 148–151. 1946.

Zeller, S. M., & Dodge, C. W. Melanogaster. Mo. Bot. Gard. Ann. **23**: 639–655. 1936.

Zundel, G. L., et al. A note on the status of the generic name Urocystis. Phytopathology **30**: 453–454. 1940.

3(4):495–498 FARLOWIA JULY, 1949

SOME NEW SPECIES AND FORMS OF MARINE ALGAE FROM NEW ZEALAND

V. J. CHAPMAN

CHLOROPHYCEAE: CLADOPHORALES.

Wittrockiella salina sp. nov. (Fig. 1)

Planta minutissima, constante e brevibus ramosis filamentis simplices vel furcatis rhizoidis cellulis habentibus; cellulis latitudine et longitudine multum inter se differentibus, interdum paene quadratis, interdum 6-cies longioribus quam latioribus; cellula geniculata saepe praesente, plerumque materiem densiorem habente, pro more 150 x 198 μ diametro; chloroplaston reticulatum; sporangia ignota.

Plants microscopic, consisting of short, branched filaments with simple or forked rhizoidal cells; cells very variable in width and length, ranging from almost quadratic to six times as long as broad; chloroplast reticulate; many of the filaments have a "knee" cell usually with denser contents, av. dia. 150–198 μ. Reproduction unknown but zoospores or akinetes suspected to be produced from the "knee" cells.

In the shade of overhanging rocks near high watermark of spring tides, Stanmore Bay, Whangaparoa peninsula, New Zealand. Type specimen in herb. Auckland Institute and Museum.

This species is so minute that it is readily overlooked. At Stanmore Bay it was found entwined in the basal portion of Enteromorpha plants. The plant is extremely interesting because the only other species of this genus is from fresh water. There would seem little doubt, however, from the nature of the thallus, that its proper place is in the genus Wittrockiella. At Stanmore Bay a second collection was made after a lapse of two months and there was no evidence of great change. This is an important point because at first it was thought that the specimens might be young plants of some species of Cladophora or Cladophoropis.

CHLOROPHYCEAE: ULOTRICHALES.

Enteromorpha minima f. **fastigiata** form. nov. (Fig. 2)

Plantis minutis, ad 5 mm. altis, cristatis, ramis expandis, ad 200 μ latis, e basi attenuata orientibus; apice ramorum singulorum proliferationibus numerosis profuse gemmato; proliferationibus alibi raris, cellulis non in series dispositis, 4–6 μ diametro, 5–8 μ altis, parietibus crassis, chloroplaston cellulam complens; membrana 25–28 μ crassa a parte interiore 12 μ a parte exteriore 8 μ crassa.

Plants minute up to 5 mm. high, tufted, branches expanding up to 200 μ wide from an attenuated base; apex of each branch profusely beset with numerous proliferations, proliferations rare elsewhere; cells not arranged in rows, 4–6 μ dia. 5–8 μ high; walls thick, choroplast filling the cells; membrane 25–28 μ thick, walls 12 μ thick on the inside and 8 μ on the outside.

Growing in the shade of overhanging rocks near high watermark of

spring tides. Stanmore Bay, Whangaparoa peninsula, New Zealand. Type specimen in herb. Auckland Institute and Museum.

This is a very distinct form of a well-known and wide-spread species. It is most closely allied to var. *glacialis* but it differs in that the main proliferations are at the apices rather than at the bases of the branches: the membrane is also twice as thick as it is in var. *glacialis*. There is the possibility that this particular form is determined by the environmental conditions under which it grows. Immersion cannot be frequent, the light intensity must be reduced and there must be a considerable degree of exposure to desiccation. For this reason it is described as a new form rather than as a new variety.

Enteromorpha bulbosa f. **foliacea** form. nov. (Fig. 3)

Thallus subtilis, axe primario compresso, numerosis brevibus frondosis complanatis proliferationibus praeditus, basi attenuato, apice conspicue obtuso; cellulis non in series dispositis, parvis, 5–16 μ diametro, pro more 8–10 μ, 15 μ altis; membrana 22 μ crassa, a parte interiore 5 μ crassis, a parte exteriore vix crassatis; chloroplaston cellulam complens.

Plants fine, main thallus compressed and beset with numerous short, leafy, flattened proliferations, attenuate at the base and markedly obtuse at the apex; cells not arranged in rows, small, 15–16 μ diameter av. 8–10 μ, 15 μ high; membrane 22 μ thick, walls 5 μ thick on the inside but scarcely thickened on the outside; chloroplast filling the whole cell.

American River, R. I. Adelaide, South Australia. Type specimen in herb. Auckland Institute and Museum.

I am indebted to Dr. B. Womersley of Adelaide for the opportunity of examining this form. From the general character of the thallus, cell structure, cell size and membrane it clearly belongs to *E. bulbosa*, but the very characteristic proliferations are quite unlike the normal branches. I am not certain whether these proliferations are a result of the type of habitat in which the plant is growing. Because there is this distinct possibility I have preferred to regard it as a form rather than as a variety.

CHAETOPHORACEAE: ULOTRICHALES.

Sporocladopsis novae-zelandiae sp. nov. (Fig. 4)

Plantis minutis, epiphyticis, constantibus e prostrata serie 1 cellulam crassa, e qua oriuntur filamenta simplicia erecta; filamentis ad 40, pro more 20–25 cellulas longis; cellulis 5.5–7.5 μ latis, 1½–2½-cies longioribus quam latioribus; sporangiis sessilibus vel in culmo unicellulari gestis, per totum prostratum thallum distributis vel gestis, magis minusve secunde in filamentis erectis vel terminalibus in filamentis erectis, 9.3–11.3 μ latis, 17–22.5 μ longis, per foramen apicale dehiscentibus.

Plants minute, epiphytic, consisting of a prostrate layer one cell thick from which simple, erect filaments arise; filaments up to 40 cells long, average 20–25 cells; cells 5.5–7.5 μ wide; 1½–2½ times as long as broad. Sporangia sessile or borne on a unicellular stalk, distributed over the entire prostrate thallus or borne more or less secundly on the erect filaments or terminal on erect filaments, 9.3–11.3 μ wide, 17–22.5 μ long, dehiscing by an apical pore.

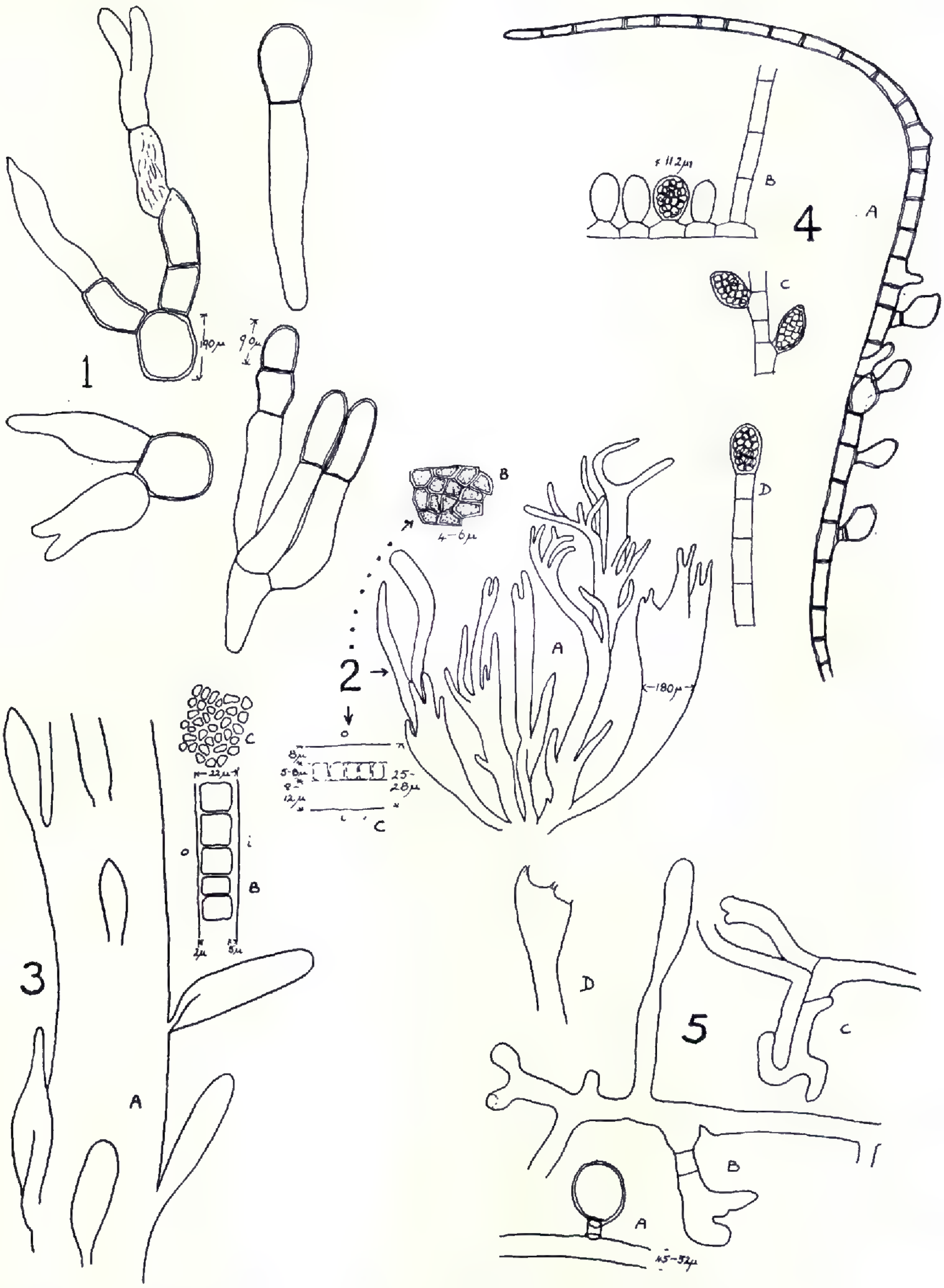

Fig. 1. *Wittrockiella salina.* Representative plants, all to same scale.

Fig. 2. *Enteromorpha minima* f. *fastigiata.* **A,** part of the plant. **B,** cells in surface view. **C,** section through the thallus; "o" is outer wall, "i" inner wall of membrane.

Fig. 3. *Enteromorpha bulbosa* f. *foliacea.* **A,** part of thallus. **B,** section of thallus to show membrane. **C,** cells in surface view.

Fig. 4. *Sporocladopsis novae-zelandiae.* **A,** erect filament with sporangia. **B,** prostrate thallus with sporangia and erect thread. **C,** sporangia with apical pore. **D,** short erect filament with terminal sporangium. (All to same scale).

Fig. 5. *Derbesia novae-zelandiae.* **A,** stalked sporangium. **B,** part of thallus. **C,** appressed arms of thallus. **D,** appressed arm removed to show hooks. (All to same scale).

Epiphytic on Pachymenia and Carpophyllum, Bay of Islands, New Zealand. Type specimen in herb. Auckland Institute and Museum.

This is a very characteristic species and it clearly belongs to the Chaetophoraceae. In some respects it is not unlike certain species of Pilinia e. g. *P. morsei*, but the development of terminal and lateral sporangia on the erect filaments as well as from the prostrate portion suggest its affinities more properly lie with the genus Sporocladopsis described by Nasr [1] from Egypt. It does not agree with any of the known species of this genus. With the discovery of this species in New Zealand there is a discontinuity in the genus but this may be more apparent than real. The plants are minute and could well be overlooked, especially if they did not occur in abundance. Subsequent search may show that the genus is more widely spread in the Indo-Pacific. Search should certainly be made for it in Australia and Tasmania.

CHLOROPHYCEAE: SIPHONALES.

Derbesia novae-zelandiae sp. nov. (Fig. 5)

Thallo e filamentis coenocyticis constante, irregularitis vel dichotomis ramosis; filamentis 37–52 μ latis; generatione asexuali per zoosporangia 95–102 μ lata, 120–150 μ longa, lateraliter gesta in uno culmo cellulis ornato; membra ad generationem sexualem abesse videntur.

Thallus composed of coenocytic filaments, branching irregular or dichotomous; filaments 37–52 μ wide; asexual reproduction by means of zoosporangia 95–102 μ wide and 120–150 μ long, borne laterally on a single celled stalk; sexual reproductive organs apparently absent.

On *Corallina officinalis* in rock pools, Milford, Narrow Neck, Auckland, New Zealand. Type specimen in herb. Auckland Institute and Museum.

This species is somewhat smaller in its measurements than *D. marina* (*D. tenuissima*) but is rather larger than *D. vaucheriformis*. Apart from these differences, however, one of the most interesting features is the tendency of certain portions of filaments from the same or adjacent plants to become appressed to one another (Fig. 5) and to be held in position by minute appendages. This may represent a degenerate form of sexual reproduction though no evidence has been seen of zygote formation.

I am grateful to Mr. L. W. Crawley for the latin diagnoses.

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[1] Nasr, A. H. 1947. Synopsis of the Marine Algae of the Egyptian Red Sea Coast. Bull. 26, Fac. Sci. Fouad 1. Univ. Cairo p. 25.

3(4):499–502 FARLOWIA JULY, 1949

THE NEW ZEALAND SPECIES OF BOSTRYCHIA RELATED TO BOSTRYCHIA SCORPIOIDES MONT.

R. F. DE BERG

Hooker (1855, 1867) described from New Zealand two species of Bostrychia which he placed close to the European *Bostrychia scorpioides* Mont., viz. *B. harveyi* Mont. and *B. distans* Harv.

However, Post (1936) in her monograph on the genus Bostrychia, united *B. harveyi* Mont. with *B. scorpioides* Mont. stating "*B. harveyi* und *B. scorpioides* sind in allen Merkmalen identish". *B. distans* she still regards as distinct but reduces it to a form of *B. scorpioides* Mont. separating it from the main species chiefly by its poorer branching and fresh water habitat.

In New Zealand *B. scorpioides* (as defined by Post) is widely distributed occurring on rocks, fallen stumps and bases of plants in either the littoral region of tidal flats and estuaries, or immersed in fresh water streams. From a consideration of many specimens collected from a wide range of habitat conditions, it appears that all the New Zealand forms are very closely related, but differ sufficiently from the European *B. scorpioides* Mont. to be separated specifically from it. It is suggested that the name *B. harveyi* Mont. be revived for the New Zealand plants.

B. harveyi was first described by Montagne from plants collected in Chile. The present author has not had an opportunity of examining plants from South America, but there are New Zealand specimens in the Laing herbarium (Canterbury University College) * determined by Troll as *B. harveyi*, presumably after comparison with authentic material.

In *B. scorpioides* (Fig. 3) the frond is composed of polysiphonous filaments consisting of a central siphon surrounded by several rows of pericentral cells. Longitudinally there are two pericentral cells to each central cell. The pericentral cells may be naked (ecorticate) or, by anticlinal and periclinal divisions, may give rise to one, or several, outer layers of smaller rectangular cells (corticate).

The main difference between *B. scorpioides* Mont. and the New Zealand plants is that in the European plant, cortication of the pericentral cells occurs within 50–100 μ of the tips of all the branches while, in the New Zealand plants, except in the encurled apical branchlets, cortication takes place many millimetres from the tips, so that most of the ultimate branchlets are ecorticate. The early cortication produces a much more robust plant, and thus the New Zealand plants are always more slender than the European.

Another striking difference is afforded by the position of the cystocarps. In *B. scorpioides* Mont. they are terminal (Newton pp. 333-4), but in

* At present the Laing herbarium is on temporary loan to the Auckland University College.

material from little Barrier Island and Helensville (collected by Miss L. B. Moore, 1941 and 1944) the cystocarps are lateral in position. Apparently these two collectings are the first (and only) cystocarpic material that has been found in New Zealand.

Within New Zealand the individual plants of *B. harveyi* show considerable variation in the texture of their fronds, but of importance in comparison with *B. scorpioides* is the fact that the more slender forms show no fundamental change in structure, e. g. there are no great differences in the degree of cortication in the different specimens. To some extent the range of variability appears to be correlated with the salinity of the water in which they grow. In general, the fresher the water the more slender and delicate will be the fronds. The plant occurs most commonly in brackish water, particularly tidal estuaries, where the salinity can vary greatly, so that often no true line can be drawn between salt and fresh water habitat. Nor can all the specimens be separated readily into "salt" and "fresh" water forms. It is therefore preferable, although the extreme fresh water forms are quite distinct, to retain all the different variations within the same species and to separate the extreme fresh water forms as ecad *distans*.

Bostrychia harveyi Mont. (Fig. 1)

Plants dark purple, tufted, composed of very short, stoloniferous filaments attached by small holdfasts and giving rise to erect fronds 3–8 cms. long; erect fronds filiform, angularly flexuous, 3–4 pinnate; branching alternate at the base but subdichotomous at the apices of the main axis and branches: branches distichous, spreading 10–25 mm. long, 100–200 μ in diameter and clothed with simple or pinnate branchlets 3–7 mm. long: apical branchlets 3–5, shorter and stouter than the main branchlets and with incurled tips; axial cells normally surrounded by 6 rows of pericentral cells, rectangular in surface view, 20–25 μ by 15 μ; cortical cells square in surface view 15–20 μ diameter; haptera often numerous, arising as proliferations from the pericentral cells, mainly at or near the points of branching: tetrasporangial stichidia linear-oblong, acute, 140 μ in diameter and 450–500 μ long, apical (usually) or intercalary; cystocarps globose, approximately 240 μ in diameter, borne laterally ½–1 mm. from the tips of the branchlets.

Marine and brackish waters.

North Island: "Bay of Islands, Island Bay, Wellington, Coromandel, Kawhia, Paterson's Harbour, Auckland;" (Post, 1936, p. 39); "Kaipara; Kerikeri; Oronga Bay; Mick's Creek — Warkworth." (Post, 1938, p. 210); Helensville, Porirua Harbour, Waikanae (L. B. Moore).

South Island: "Kaipai, Banks Peninsula, Avon, Brighton, Heathcote, Warrington, Long Bay, Invercargill, Purakino;" (Post, 1936, p. 39); Collingwood Estuary (L. B. Moore).

Stewart Island: Native Island — Patterson Inlet (L. B. Moore); Price's Bay (V. W. Lindauer).

Probably widely distributed throughout the Dominion.

Bostrychia harveyi ecad **distans** (Harv.) comb. nov. (Fig. 2)

Similar to *B. harveyi*, but with more slender fronds and fewer branches. Apical branchlets 2–3, less encurled than in *B. harveyi*.

Fig. 1. *Bostrychia harveyi.*
Fig. 2. *B. harveyi* ecad *distans.*
Fig. 3. *B. scorpioides.*
All figs. × 20.

Mainly fresh water.

North Island: Kowhai River, Waterfall — Long Bay (Post, 1936, p. 31); Faraheru Stream — Poverty Bay, Swanson Stream — Auckland (N. J. Butler); Mokaroa Stream — Auckland (J. A. Carnahan); Cannibal Creek — Anawhata (V. J. Chapman); Mick's Creek — Warkworth (L. M. Cranwell); Pig Gully — Cape Brett, Upper Frenchman's Swamp (V. W. Lindauer); Stream — Waipoua Forest (L. H. Millener); Gollan's Stream — Wellington, Happy Valley Stream — Bethells, Little Barrier Island, Orongorongo River, (L. B. Moore).

South Island: Doubtful Sound (L. M. Cranwell and L. B. Moore); Banks Peninsula (Post, p. 37, 1936). Buller Point — Westport (L. B. Moore).

Stewart Island: Stream — Price's Bay (V. W. Lindauer).

Probably widely distributed throughout the Dominion.

The Author wishes to thank the following persons for help in various directions: Miss L. B. Moore and Mr. V. W. Lindauer both for advice and collection of herbarium material; Dr. T. Levring for advice; Dr. M. Parke, Misses A. M. Rodewald, S. A. Rose, Messrs. J. A. Carnahan, and R. M. Innes, and Victoria University College, for collecting of material; Auckland Institute and Museum for the use of herbarium material.

Finally she wishes to thank Professor V. J. Chapman for suggesting the subject and also for advice throughout.

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LITERATURE CITED

Hooker, J. D. 1855. Flora Novae Zelandiae. pp. 225–6. London.

————. 1867. Handbook of the New Zealand flora p. 665. London.

Newton, L. 1931. A Handbook of the British Seaweeds. London.

Post, E. Von. 1936. Systematische und pflanzengeographische Notizen zur Bostrychia — Caloglossa — Association. Rev. Alg. **9:** 1–84.

————. 1938. Weitere Daten zur Verbreitung des Bostrychietum II. Hedwigia, **78:** 202–215.

3(4):503–507 FARLOWIA JULY, 1949

A STUDY OF ANTIBIOTIC ACTIVITY OF SOME BASIDIOMYCETES [1] [2]

TRENT LAVIANO

My interest in this problem was first aroused in the summer of 1946, after discussing with faculty members of the Mountain Lake Biological Station of the University of Virginia the studies which were made by Wilkins and Harris in England and Robbins and his group at the New York Botanical Garden. Because of the abundance of fungi in the Mountain Lake area of Virginia, this was considered an ideal place to carry on such a study. Parts of the summers of 1946 and 1947 were devoted to this investigation, using the fungi as they became available.

A total of 42 species of Basidiomycetes was investigated, using as test organisms: *Staphylococcus aureus*, *Streptococcus hemolyticus*, *Escherichia coli*, *Mycobacterium phlei*, *Mycobacterium smegmatis* and *Mycobacterium tuberculosis (avian)*.

Staph. aureus and *E. coli* were grown in nutrient broth for 24 hours at 37° Centigrade and then plated with nutrient agar.

Strep. hemolyticus grown in Trypticase Soy broth for 24 hours at 37° C. was plated with Veal Infusion Agar.

M. phlei, *M. smegmatis* and *M. tuberculosis* (*avian*) were individually streaked on nutrient agar plates and incubated for 24 hours at 37° C. The growths were washed off the agar, using Trypticase Soy broth, and the washings were plated with Veal Infusion Agar and again incubated for 24 hours at 37° C.

The methods employed were:

I. Crude extracts (obtained by squeezing mushrooms through gauze) were placed in uniform porcelain cylinders, size 6.0 mm. in diameter.

II. Pieces of mushrooms of uniform size, which were kept as free from bacterial contamination as possible, were plated against the organisms. This was done by peeling off the cuticle of the pileus, then passing a sterile cork borer, 0.7 cm. in diameter, through the mushroom and cutting off the gills with a flamed knife.

III. Alcohol extracts of mushrooms: Small pieces of mushroom were placed in alcohol (95%) and allowed to stand for three to four days and then allowed to evaporate at room temperature. The resulting residue was dissolved in .85% saline and placed in porcelain cylinders.

IV. Acetone extracts, using the same procedure as above.

[1] This study was partially financed by grants made by the Committees on Research of the University of Virginia and the Virginia Academy of Science.

[2] I wish to express my appreciation to Dr. George McL. Lawson, head of the Department of Bacteriology and Preventive Medicine of the University of Virginia for his many suggestions and for the use of his bacteriological equipment; also to Dr. Rolf Singer, assistant curator of the Farlow Herbarium of Harvard University, for the identification of the fungi and advice in mycological questions.

All the above methods were not tried on every species. Only in a few instances were alcohol and acetone extracts tested. These showed positive results, but because of the lack of time and assistance it was not feasible to carry on a detailed study of these methods.

The 27 fungi which showed no bacteriostatic activity are as follows:

Agrocybe semi-orbicularis (Bull. ex Fr.) Fayod ex aut.
Amanita rubescens (Pers. ex Fr.) Gray
Armillariella mellea (Fl. D. ex Fr.) Karst.
Boletinus pictus (Peck) Peck
Clavariella formosa (Pers. ex Fr.) Sing. (*Clavaria formosa* Pers. ex Fr.)
Cortinarius armillatus (Fr.) Fr.
Cortinarius torvus (Fr.) Fr.
Gomphus floccosus (Schwein.) Sing.
Hericium caput-ursi (Fr.) Banker
Hygrocybe sp.
Laccaria ochropurpurea (Berk.) Peck
Laccaria laccata (Scop. ex Fr.) Berk. & Br.
Lactarius piperatus (L. ex Fr.) Gray
Lactarius quietus (Fr.) Fr.
Leccinum albellum (Peck) Sing. (*Boletus albellus* Peck)
Naematoloma sublateritium (Fr.) Karst. (*Hypholoma perplexum* Peck)
Phylloporus rhodoxanthus (Schwein.) Bres. ssp. *Americanus* Singer
Pluteus cervinus (Schaeff. ex Secr.) Quél.
Poria sp.
Psathyrella hydrophila (Bull. ex Fr.) Sing.
Russula densifolia (Secr.) Gillet
Russula emetica (Schaeff. ex Fr.) Pers. ex Gray *sensu lato*
Strobilomyces floccopus (Vahl ex Fr.) Sacc.
Tylopilus alboater (Schwein.) Murr.
Tylopilus felleus (Bull. ex Fr.) Karst.
Tyromyces Spraguei (Berk. & Curt.) Murr. (*Polyporus Spraguei* Berk. & Curt.)
Xeromphalina campanella (Batsch. ex Fr.) Kühn & Maire (*Omphalia campanella* Batsch. ex Fr.) Quél.

Ten of the fungi showed slight bacteriocidal activity on *Staph. aureus*. Each was tested two to three times and showed a clear area within and around the cylinders varying from 0.9 cm. to 1.2 cm. These fungi are:

Boletus edulis Bull. ex Fr.
Boletus sp. (sect. Luridi)
Cantharellus cibarius Fr.
Clavariella botrytis (Pers. ex Fr.) Sing. (*Clavaria botrytis* Pers. ex Fr.)
Craterellus cornucopioides (L. ex Fr.) Pers.
Craterellus lutescens Fr.
Lactarius volemus Fr.
Omphalotus olearius (D.C. ex Fr.) Fayod (*Clitocybe illudens* (Schw.) Sacc.)
Russula cyanoxantha (Schaeff. ex Schwein.) Fr.
Tremellodendron candidum (Schwein.) Atk.

Five of the fungi showed consistently good results. They are as follows:

Cortinarius sp.[3]
Dentinum repandum (L. ex Fr.) Gray (*Hydnum repandum* L. ex Fr.)

[3] A specimen of this fungus was examined by Dr. A. H. Smith of the University of Michigan, who declared it to be an undescribed species of the genus Cortinarius.

Hydnum Murrillii (Banker) Sacc.
Lactarius deceptivus Peck
Russula foetens Pers. ex Fr. (mostly var. *Laurocerasi* (Melzer) Sing.)

The above five species, which showed consistently good results, were tried in different ways against all six organisms previously mentioned. No fungi other than these five were tested against the genus Mycobacterium.

Hypomyces chrysospermum (Bull. ex Fr.) Tul. *(Sepedonium* stage), an imperfect Ascomycete grows on many of the Boletaceae in the area. It was thought advisable to culture this fungus; consequently, cultures were grown on Sabaraud's medium at room temperature. After four days there was an abundance of growth on the medium. A loopful of agar, on which the mycelium of this fungus was growing, was placed on three plates, each plate containing respectively: *Staph. aureus*, *Strep. hemolyticus* and *E. coli*. These plates were incubated for 24 hours at 37° C. No bacteriostatic action was noted in any of the three plates. It was therefore concluded that this parasitic fungus was not responsible for any of the positive results which were obtained.

The possibility that the antibiotic activity shown by these Basidiomycetes may be the result of saprophytic or parasitic organisms growing within their carpophores cannot be disregarded; however, work done by other investigators in this field indicates that antibiotic activity is inherent in the Basidiomycetes.

The following table summarizes the antibiotic activity of the five fungi on which most of the work was done against the six organisms. The measurements were taken to include the width of the cylinder or the pieces of fungi. Plus and minus signs are used to denote the degree of antibiotic activity, minus signs meaning no antibiotic activity and the plus signs meaning as follows:

+ 1.0 to 1.4 cm. of clearing, ++ 1.5 to 1.9 cm. of clearing, +++ 2.0 to 2.4 cm. of clearing, ++++ 2.5 to 3.0 cm. of clearing.

Using the Taylor Colorimeter, pH determinations were run on the extracts of the five previously mentioned fungi in an effort to determine whether or not the inhibition of bacterial growth resulted from an acid environment. The following results were obtained: *Russula foetens* pH 6.0, *Dentinum repandum* pH 6.3, *Hydnum Murrillii* pH 5.2, *Lactarius deceptivus* pH 5.6, *Cortinarius* sp. pH 5.5.

Since all these pH values are on the acid side, the next procedure was to bring the fungi up to neutrality in order to determine whether or not there would be any appreciable change in their ability to inhibit bacterial growth. Pieces of mushroom were soaked in sterile N/20 NaOH, the excess wiped off on sterile filter paper, and plated against the six different bacteria. There were no differences in the results so it was concluded that the hydrogen-ion concentrations of the mushroom juices were not the primary factors in preventing bacterial growth. The results shown in the

Organism	*Staph. aureus*		*Strep. hemolyticus*		*E. coli*		*M. phlei*	*M. smegmatis*	*M. tuberculosis (avian)*
Method	Extract	Piece of Fungus	Extract	Piece of Fungus	Extract	Piece of Fungus	Piece of Fungus	Piece of Fungus	Piece of Fungus
Russula foetens	++	++	++	++	−	−	+	++	++
Dentinum repandum	++	+	+	+	−	−	+	−	+
Hydnum Murrillii	+++	+++	+++	+++	−	*	+++	++	++
Lactarius deceptivus	++	+	+	+	−	−	−	−	−
Cortinarius	++	+++	++	+++	++	++++	+++	−	+

* On two occasions inhibition was observed, but in these instances extract was not tried.

preceding table include those results obtained with alkali soaked mushrooms.

A total of 134 inoculations were made in an attempt to culture these fungi. The media consisted of Malt extract agar, Potato dextrose agar, a modified Czapek-Dox agar, [4] and soil agar. All attempts were unsuccessful.

REFERENCES

Robbins, W. J., Hervey, A., Ross, W. D., Ma, R., and Robbins, W. C. — (1945) Bull. Torrey Bot. Cl. **72**: 165.

Wilkins, W. H. — (1945) Trans. Brit. Mycol. Soc. **28**: 110. — (1946a) Brit. J. Exp. Path. **27**: 140. — (1946b) Ann. Appl. Biol. **33**: 188. — (1947) Brit. J. Exp. Path. **28**: 53. — (1947) Brit. J. Exp. Path. **28**: 247.

Wilkins, W. H., & Harris, G. C. M. — (1942) Brit. J. Exp. Path. **23**: 166. — (1943a) Ibid. **24**: 141 — (1943b) Ann. Appl. Biol. **30**: 226. — (1944a) Nature (Lond.) **153**: 590. — (1944b) Ibid. **154**: 578. — (1944c) Brit. J. Exp. Path. **25**: 135. — (1944d) Ann. Appl. Biol. **31**: 261. — (1944e) Trans. Brit. Mycol. Soc. **27**: 113.

[4] After Wilkins and Harris.

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